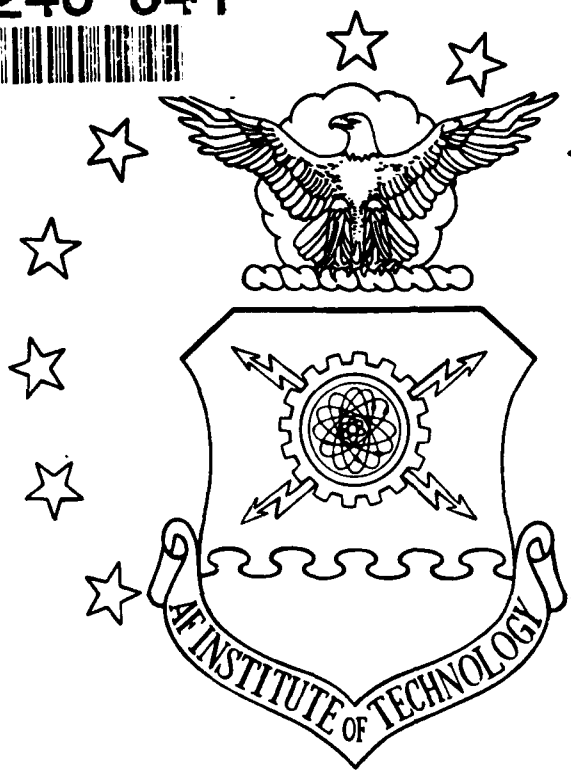

THE ADVANCED TACTICAL FIGHTER EARLY, STRUCTURED, AND CONTINUOUS USER-INTERFACE PROCESS: A SYSTEM PROGRAM OFFICE/USER TEAM-BUILDING CONCEPT

THESIS

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AFIT/GSM/LSR 91S-3

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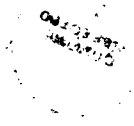

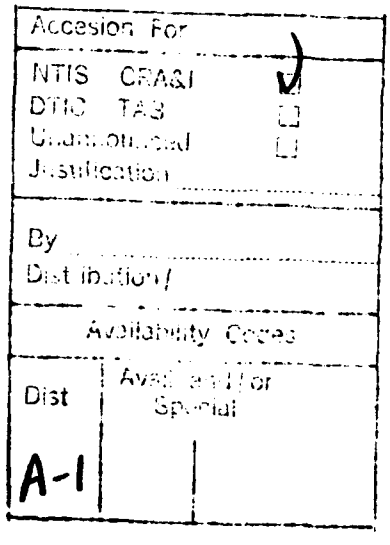

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THE ADVANCED TACTICAL FIGHTER EARLY, STRUCTURED, AND CONTINUOUS USER-INTERFACE PROCESS: A SYSTEM PROGRAM OFFICE/USER TEAM-BUILDING CONCEPT

THESIS

Presented to the Faculty of the School of Systems and Logistics

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Master of Science in Systems Management

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Captain, USAF

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Abstract

The objective of this study was to develop an acquisition management tool that would improve the working relationship between the System Program Office (SPO) and the User during the Demonstration and Validation phase. It accomplished this by documenting the Advanced Tactical Fighter (ATF) Early, Structured, and Continuous (ESC) user-interface process in a draft handbook. This handbook was also developed to support a continuing Command-wide effort to improve the acquisition process.

The study found that the ATF ESC process was also developed in response to senior Air Force management guidance, lessons learned, and ATF SPO management direction. The ATF ESC process was easily incorporated into the SPO's acquisition strategy, and it did not affect the current Tactical Air Force requirements process and the player's roles and responsibilities. It has also been in operation for four years, but was not documented.

The study recommended that the handbook be formalized and provided to other SPOs as a management tool for establishing an effective SPO-User relationship. The handbook could be modified and used as a SPO training tool with additional research. The handbook could also be

modified to address the AFSC/AFLC merger as well as FSED, but additional research would need to be accomplished. Finally, after the ATF program is two to three years into Full Scale Development, the effectiveness of the ATF ESC process could be measured against the F-15 and F-16 programs by comparing the number and type of changes to the technical/operational characteristics documented in the Selected Acquisition Report (SAR).

THE ADVANCED TACTICAL FIGHTER EARLY, STRUCTURED, AND CONTINUOUS USER-INTERFACE PROCESS: A SYSTEM PROGRAM OFFICE/USER TEAM-BUILDING CONCEPT

I. Introduction

Background

The declining defense budget and the rising cost of weapon systems have forced Air Force decision makers to reduce the force structure and emphasize technological solutions. This has complicated the process of translating operational requirements into a weapon system design through the requirements generation process. In addition, changing threats, program budgets, and program schedules continue to press the System Program Office (SPO) and the user to refine or even modify the initial requirements, especially in the early phases of an acquisition program. Therefore, it is important that the SPO and the user develop and maintain an early, structured, and continuous interface so that there is a match between the requirements and achievable technologies to baseline an executable program by Full Scale Engineering Development (FSED) (1).

General Issue

The Acquisition Process Excellence (APEX) committee was established in October 1989 by General Bernard P Randolph, former commander of Air Force Systems Command (AFSC).

APEX was a multi-functional team consisting of representatives from each AFSC field organization, HQ AFSC, SAF/AQ, and the user. The mission of APEX was to create a revolutionary team acquisition process that destroyed barriers, inspired opportunity for improvement, and increased responsiveness to the user by baselining, evaluating, and identifying the "best practices" in any acquisition program throughout the Command (15).

The first phase of the study was completed in March 1990. The committee concluded that the process of developing acquisition strategies lacked a consistent, systematic approach, was not responsive to the user, did not comprehensively address program risks, and resulted in a lack of corporate commitment and inexecutable programs (15). In addition, during the APEX teams's data collection phase, which involved surveying program managers and functional experts across the Command, recurring inputs on perceived acquisition problems centered on ways to improve the relationship between AFSC and the user (15).

The APEX team recommended a shift in planning emphasis to the front end of all system acquisitions, and the development of more effective team processes that would optimize the contributions and roles of all the participants-users, contractors, program managers, and functional managers-in the acquisition process (15). The Advanced Tactical Fighter (ATF) SPO has developed a similar

process, the Early, Structured, and Continuous (ESC) user-interface process, for improving their relationship with the user as well as other participants. This has resulted in a highly integrated, coordinated, and effective team acquisition process for the Demonstration and Validation Phase of their program. It also resulted in a stable, achievable design, which meets the user's requirements, at the end of this phase. It's been in operation for four years and it was supported by Senior Air Force management, but it has not been documented.

ATF Program Overview

The ATF is being developed as an Air Superiority fighter to dominate the threat in the year 2000 and beyond with a primary design mission of offensive counterair (13). Developing a system with improved performance characteristics, such as supersonic persistency, high maneuverability, and better combat radius, within congressionally mandated goals for a 50,000 pound aircraft at 35 million dollar average unit flyaway costs (base year 1985 dollars), was a challenging task requiring optimization of numerous variables which must be treated in an integrated analysis (13).

The program just completed a competitive Demonstration and Validation (D/V) phase. During the D/V phase, the most promising technical alternatives from the Conceptual Exploration/ Demonstration (CE/D) are refined by making

performance tradeoffs whereby high-cost features providing only marginal performance gains are deleted from the system (37:301). It will enter Full Scale Development (FSD) in mid-1990. Production options are scheduled to be exercised beginning in 1996 with the Tactical Air Force receiving aircraft beginning in 1999.

ATF ESC User-Interface Process

The ATF SPO developed the ESC user-interface process in response to a need for a better relationship between the SPO and the user in their D/V phase. The relationship was critical during this phase because the SPO and the user had the greatest opportunity to change the weapon system design before it was baselined in Full Scale Engineering Development (FSED) (23). The primary objectives of the ATF ESC process were to add justification and accountability to the requirements process by involving and educating the User during the trade studies process, and to ensure their continued support in a very political program (1).

The user was involved in every aspect of the program to ensure the operational requirements became an integral part of the weapon system design process. The degree of interaction between the User and the engineering communities was unparalleled. Representatives from the TAF, Air Force Logistics Command (AFLC), and Air Training Command (ATC), for the ATF, were collocated in the program office and treated as members of the SPO. Formal agreements, such as

Memorandums of Agreements (MOAs), were not needed due to the process's support from senior Air Force management. The ATF SPO established a team of experts for Operations and Support (O&S) and Manpower, Personnel, Training, and Safety (MPTS) functions within the SPO to ensure that they were integrated into the system design. The User attended working groups, Technical Interchange Meetings (TIMs), program reviews, and briefings at all levels. The user participated in Mission Area Analysis/Cost and Operational Effectiveness Analysis (MAA/COEAs) and other ATF-related studies.

Specific Problem

Historically, the user has inadvertently been excluded from the acquisition process after the approval of the Mission Element Need Statement (MENS), or became proactive after the weapon system design was frozen. Typically, therefore, the process of identifying and refining weapon system requirements through the trade study process is not responsive to program changes, and the results lack justification and traceability because SPOs have not developed and maintained an early, structured, and continuous interface with the user.

The APEX team identified and validated a number of key areas related to the requirements generation process, where the SPO and user relationship could be improved to make the acquisition process more effective. They were: cooperation and exchange of ideas, disciplined requirements definition,

team approach, Mission Area Analysis and Operational Cost and Effectiveness Analysis (MAA/COEA), concept DIR studies, standard/ simplified approach to major and non-major programs, exclusion from acquisition process, and improved synergism of documentation (16). The Team's recommendation, the Early Acquisition Strategy, addressed these concerns, but it has not been implemented.

The APEX committee continues to work with functional experts and program managers throughout the Command to identify the "best practices" in any acquisition program to enhance the acquisition process. Also, the EAS strategy may not be implemented for some time because it represents a major change to the present Air Force weapon system acquisition process.

Research Objective

The objective of this study was to develop an acquisition management tool that would improve the relationship between the SPO and the User during the acquisition process, so that the trade study process could be improved. This was accomplished by documenting the ATF ESC user-interface process in a draft handbook. This handbook, the product of a comprehensive study of the ATF ESC interface process with the User, was developed to support a Command-wide effort to improve the acquisition process. The handbook identified specific management and engineering techniques that were developed by the ATF SPO

and the user, and which fall under the following concern areas from the APEX study: cooperation and exchange of ideas, disciplined requirements definition, team approach, exclusion from acquisition process, and improved synergism of documentation.

The handbook will also include possible improvements to the ATF approach, as perceived by four selected groups. The four groups included the APEX team, ATF SPO, user, and contractor personnel.

The population consisted of APEX team members, program directors, and functional experts involved in the APEX study. Personnel from the ATF SPO included SPO management, functional experts, and Tactical Air Command Liaison Officer (TACLO). Personnel from the user included TAC/DR, the APEX team, and AFSC. The defense contractors included the managers involved in the ATF user-interface process, as well as prime contractors' OPR's.

Investigative Questions

The task of developing the handbook inspired some specific questions which guided the research. These questions are presented next:

1. What factors caused the ATF SPO to develop the ESC interface process with the user?

2. What changes were required in the ATF SPO's acquisition strategy to support the ESC interface process with the user?

3. What engineering and management techniques were developed by the ATF SPO for the ESC interface process with the user?

4. How can these engineering and management techniques be generalized and applied to other major Air Force acquisition programs?

5. Into which acquisition phase should the program director implement the ATF ESC interface process with the user?

6. What approval cycle is required to implement the ATF SPO ESC interface process with the user?

Scope

This study was designed to support a continuing, command-wide effort to improve the acquisition process and critical subprocesses. The goal was to document the ATF ESC process and provide a management tool to other Air Force acquisition programs in this area.

This was accomplished through a literature review of all acquisition improvement strategies and implementation plans, including the ATF ESC user-interface process, as well as personnel interviews. Initially, this study used the Defense Technical Information Center (DTIC) and professional journals from the Air Force Institute of Technology (AFIT) library. Later, Advanced Tactical Fighter program documentation, Air Force studies, Air Force policies and documentation, past theses, and interviews were the main sources of information due to the narrow scope of this study and the underlying assumptions.

Assumptions

The handbook was designed as a management tool for establishing an interface process with the user. Consideration should be given to the following assumptions when planning and implementing a user-interface process based on some of the ATF concepts:

1. Based on draft Defense Management Review (DMR) directions, a SPO will not be formed until after Milestone I (15).

2. User deficiencies/needs were validated by the Milestone 0 decision (15).

3. Concept Exploration and Exploration funding pool was available to fund the concept direction studies and development of alternative technical solutions (15).

4. The primary participants in the ESC process were the SPO, user, contractor, HQ AFSC, and HQ USAF.

5. The customers of process were the user, DAB II process, D/V program directors, Science Advisory Boards (SAB), System Design Reviews (SDRs), Mission Area Analysis/Cost and Operational Effectiveness Analysis (MAA/COEAS), program reviews, TIMs, and working groups.

6. The ATF ESC user-interface process is planned and implemented in the D/V phase.

7. Major programs were addressed, but the philosophy may be applicable to less-than major programs.

8. The SPO specified the requirements in the form of a threat description and preliminary system specification.

9. The acquisition strategy involved teaming arrangements, competition, and prototyping.

Limitations

The ATF ESC SPO-User team-building handbook discusses specific management and engineering activities that were implemented by the ATF SPO in response to a Command-wide

need for a better relationship between the SPO and the User during the acquisition process. The handbook is in draft form. Currently, it is applicable to the D/V phase of major acquisition programs. The acquisition process is presented from an ATF SPO viewpoint including: roles and responsibilities of the Government and contractors; documentation generated by the SPO; and objectives of the acquisition phases. Therefore, if the handbook is used as a management tool, one should consider this as well as the underlying assumptions.

Justification

The ATF-based handbook could be delivered directly to the field organizations without additional AFSC action or changes to the current TAF requirements process philosophy.

It focused on D/V activities critical to the acquisition process rather than activities associated with Mission Area Analysis (MAA) and the CE/D phase like previous user-based strategies. Therefore, it represents a different look at the acquisition process.

For example, in the APEX study, a new acquisition strategy process was defined and later called the Early Acquisition Strategy. This Early Acquisition Strategy process focused on the activities that need to be conducted during the CE/D phase while this study focused on the activities in the D/V phase (15).

Early involvement of the using and supporting command personnel greatly contributed to the success of the F-15 program. From early in the CE/D phase, TAC, AFLC, and ATC were involved during the requirements formulation and Request for Proposal (RFP) preparation (37:293). They were collocated within the SPO, and became an integral part of the F-15 team. Unfortunately, this user-interface process which was used in the CE/D phase was never documented.

Finally, the Crew Centered Cockpit Design (CCCD) Advanced Development Program Office (ADPO), OL-AC HAD/YAH (CAT), at Wright-Patterson AFB, Ohio, completed a study that:

> Developed a design process that emphasizes an early employment and more even distribution of resources to converge on a crew system design. Thus, this effort described what activities are required for crew system acquisition (which is applicable to all acquisitions), but not how the activities are performed (which would vary between the different programs. (14:Vol I,1)

The CAT model could be used as an acquisition training tool for the SPO and the user, but was not considered in this study.

System Acquisition Process

Although this study concentrated on the D/V phase of the acquisition process, it is necessary to understand the objectives of the other acquisition phases.

Briefly, weapon system programs go through a sequence of key program decisions and milestones known as the systems acquisition process or the acquisition life cycle (37:258).

The acquisition process is a logical flow progressing from the identification of a system need to operational deployment and support of the new system (37:258).

Operational Requirements. The operational requirements process is a structural process of analysis and iterative refinement by which HQ USAF and the User can document operational deficiencies and needs for validation and solution (37:301). When the analysis, otherwise known as mission area analysis, identifies a deficiency in existing agency capabilities or an opportunity to establish new capabilities in response to a technologically feasible opportunity, this will be formally set forth in a mission element need statement (MENS) (37:302).

Approval of the MNS starts the major system acquisition process by granting authority to explore alternative system design concepts. This initial approval and the establishment of a system acquisition program does not automatically mean that a new major system will eventually be acquired. With an approved need, designated agency component(s) may continue to analyze other optional means of satisfying the need in parallel with the exploration of alternative systems which may, as development proceeds, prove unacceptable.

Concept Exploration and Definition Phase. Once the need is established, a new weapon system enters the CE/D phase. The objective of this phase is to explore material

alternatives to satisfying the documented mission need. This phase generally consists of paper studies, but limited experiments and tests may be performed.

Selection of the system concepts that offer the best balance of cost, schedule, and technical performance will be made during this stage. If the selected alternatives warrant system demonstration, then approval of the SECDEF must be obtained before proceeding to the next phase.

Demonstration and Validation Phase. In the D/V phase, selected alternatives from the previous phase are further evaluated and defined. The central thrust of the effort during this phase is reduction of risk and economic uncertainty and a more detailed definition of the new system (37:262). It is important to get a handle on the requirements because the airframe cannot be changed much in FSED (23). It should be emphasized that any prototyping at this point only resembles the operational system to the point that performance testing and evaluation can be performed.

Once this phase is completed, the results are forwarded through the appropriate channels to the SECDEF for approval to proceed to the next phase.

Full Scale Engineering and Development Phase. During this phase of the acquisition life cycle, the system is designed, developed, fabricated, and tested. At the end of this phase, the design specifications and the engineering

drawings will be finalized. Testing and Evaluation (T&E) are an important part of this phase. Through rigorous T&E, the contractor and the Air Force identify and solve engineering problems (37:263). Furthermore, the T&E demonstrate that program objectives have been met and that continuation to production is warranted.

Production and Deployment Phase. During this phase, the system, including training equipment, spares, facilities, etc is produced for operational use. Testing is continued, and the system is integrated into an as close as an operational configuration as possible.

Deployment begins when the weapons are provided to the operating command. The operating command then has the responsibility to assume operation and maintenance and assume property accountability. This point is identified as initial operational capability (IOC).

Operation and Support Phase. During this phase, the user identifies shortcomings or deficiencies that must be corrected to improve performance. In addition, the other commands ensure the fielded system continues to provide the capabilities to meet the identified mission need.

Definitions

In order to understand any aspect of the acquisition process, which includes the operational requirements process, it is necessary to familiarize the reader with some related terminology.

1. Acquisition process. A capstone term used to cover the entire process of acquiring weapons from requirement generation, research, development, test and evaluation, production, operational support, product improvement, and final disposal (37:258).

2. Air Force Logistics Command (AFLC). Major Air Force command responsible for logistically supporting all Air Force activities as well as other DoD and federal agencies. The supporting command (19:68). Also known as the Supporting Command.

3. Air Force Systems Command (AFSC). Major Air Force command responsible for total Air Force research, development, testing, evaluation, and contracting for production of aerospace systems (14:Vol VII,2).

4. Air Training Command (ATC). Major air command responsible for training aircrews and maintenance personnel. The participating command.

5. Aeronautical Systems Division (ASD). Division of Air Force Systems command responsible for directing the design, development, and acquisition of major aerospace systems.

6. Aeronautical Systems Division/YF. The Advanced Tactical Fighter System Program Office. Organization within ASD responsible for managing the design, development, and acquisition of the advanced tactical fighter.

7. Concept Exploration/Definition (CE/D) phase. Weapon system acquisition phase where a SPO cadre explores generic design alternatives to satisfy a stated mission need.

8. Cockpit Automation Technology (CAT). Advanced development program responsible for development of highly disciplined and structured crew system design process including the supporting design tools and the technology (14:Vol VII,8).

9. Defense Acquisition Board (DAB). Top level DoD corporate body for system acquisition responsible for providing advice and assistance to the Secretary of Defense. Reviews the weapon system acquisition at milestone decision points (14:Vol VII,22).

10. Demonstration/Validation (D/V) phase. Weapon system phase where program characteristics (performance, cost, and schedule) are validated and refined through

extensive study and analysis, hardware development and prototype testing (14:Vol VII,22).

11. Full Scale Engineering Development (FSED). The weapon system acquisition phase where the weapon system is designed, fabricated, and tested.

12. Milestone. Major program decision points which require Secretary of Defense approval to proceed with the weapon system acquisition. Milestone 0 proceeds CE/D phase. Milestone I proceeds D/V phase. Milestone II precedes FSED (14:Vol VII,51).

13. Mission Need. Deficiencies (threat changes, decreased performance of older systems, or national security policy changes), technological opportunity or expanded mission which created the need for a new or modified weapon system (14:Vol VII,51).

14. Mission Element Need Statement (MENS). User-generated document which contains information on mission and threat, alternative concepts, technology, and funding implications of the weapon system development (14:Vol VII,52).

15. Office of Management and Budget (OMB) Circular A-109. This document is the institutional basis for major systems acquisitions for all executive agencies. It contains management principles for research, development, and acquisition.

16. Operational Requirements. Requirements specified by the user and support command including the Statement of Need (SON), the System Operational Requirements Document (SORD), and Depot Support Requirements Document (DSRD), and scenarios (14:Vol VII,54).

17. SON. Document generated by the user which identifies the initial mission need in general operational terms. Includes a Parametric Spreadsheet which describes the essential characteristics and quantitative/qualitative performance and technical requirements the user deems relevant to the mission success. Also includes a rational and requirements change sheet which provides an audit trail for agreed-to program changes, cost and performance tradeoffs, growth plans, and supporting rational for decisions (14:Vol VII,69).

18. Tactical Air Command (TAC). Major Air command responsible for tactical air operations including counterair, air interdiction, and close air support.

19. Tactical Air Command Liaison Officer. The TAC representative residing in the SPO.

20. User. End-user of the weapon system being acquired (14:Vol VII,81).

Benefits of Research

According to General Randolph, the command needs to change its philosophy on acquiring weapon systems, especially in today's environment of declining resources and clear emphasis on technological solutions to our nation's defense needs (39). He launched a campaign in late 1989 that would ultimately share the best practices found anywhere in the AFSC acquisition community. The draft handbook produced in this process will give the program director a set of guidelines for developing and implementing a user-based interface strategy for refining the system concept in D/V.

The ATF ESC user-interface strategy and process can be integrated into the operational requirements process through the APEX initiative. Specifically, it provides a unique and effective way to address requirements tradeoffs, which is critical to the TAF requirements process. Also, it fits within the current management guidelines of the TAF requirements process and was easily incorporated into the acquisition process.

The ATF SPO developed an ESC interface process with the user in the D/V phase of their program. It has been tested and accepted by the SPO and the user. This process

can be tailored to other major programs within the current guidelines of Air Force acquisition policy, documentation, and the requirements process, unlike the incompatible user-based acquisition approach the APEX committee recommended. Finally, the Air Force Inspector General (IG) reported that the ATF ESC strategy and user-interface process is innovative and effective (7).

Chapter Summary

A smooth, systematic, and effective process to make performance tradeoffs in the D/V phase of the acquisition process is long overdue. The APEX committee was formed because the current process of developing acquisition strategies lacks a consistent, systematic approach, is not responsive to the user, does not comprehensively address program risks, and results in a lack of commitment (15; 39). However, most of the initiatives related to the APEX study have ignored the interface between AFSC and the user. One initiative, Early Acquisition Strategy, placed the user in charge of an acquisition team in the CE/D phase. This approach has not been approved by the Air Force. It may change Air Force acquisition policies and procedures, and alter the TAF requirements process roles and responsibilities. The ATF SPO has developed its own user-based interface process which is early, structured, and continuous, and has been tested and accepted by the ATF SPO and the user. More importantly, this ESC interface process

does fit within the guidelines of Air Force policy. This study will identify activities that can improve the performance tradeoffs portion of the requirements process by evaluating the ATF ESC user-interface process.

Overview of Thesis

The purpose of Chapter I was to introduce the study. The background, general issue, research problem, investigative questions, scope and limitations, definitions, justification, and benefits of research were discussed.

In Chapter II, the methodology for researching and answering the research problem is discussed. This section includes an introduction of the research design, thesis sponsorship, and the research methodology for answering the investigative questions.

Chapter III outlines the major highlights of the literature review in preparation for this study.

The research findings are summarized in Chapter IV, and the conclusions and recommendations are summarized in Chapter V.

II. Methodology

Introduction

The handbook conveyed, in part, the perceptions of the APEX team, user, ATF SPO, and contractors associated with the ATF ESC user-interface process. To gather these perceptions, an orderly approach, or research method, to collect the research data was first developed.

The research method used in this study consisted of unstructured personal interviews and a literature review to identify the management and engineering techniques associated with the ATF ESC process. The study criteria as well as the general and specific problems were identified and validated, using the survey method, by the APEX evaluation of the current acquisition process. The unstructured personal interviews allowed for a more detailed and in-depth study of the ATF ESC process, and they identified possible improvements to the ATF approach.

Thesis Sponsorship. During the initial phases of defining and refining the research topic, informal discussions were conducted with the ATF TAC Liaison Officer, the ATF Director of Projects, the Chief, Analysis Branch, Directorate of Projects, Advanced Tactical Fighter System Program Office, and the Chief, Plans and Strategies Branch, Directorate of Projects, Advanced Tactical Fighter SPO. After these discussions, they concluded that a study of the

ATF ESC user-interface model and the development of a handbook for this process would be useful to other Air Force program managers.

Justification of Approach

The purpose of this research was to develop a handbook that documented a "best practice" for involving the user in the acquisition process. Eventually, this handbook could be used by other program directors and SPO personnel for developing and implementing an effective and proven SPO user-based interface strategy.

The study used results from the APEX survey and the ATF ESC user-interface process management and engineering techniques to organize and develop the handbook. The study also identified potential improvements to the ATF ESC process. Therefore, in order to accomplish this second objective, the perceptions of four groups of people had to be collected: APEX team, ATF SPO, user, and contractor.

The independent variables involved in the APEX study were categorized as attitudes and opinions. Emory points out that attitudes and opinions can only be measured through the survey method (28:158). "Surveying can be carried out by face-to-face interviewing, by telephone, by mail or a combination of these" (28:159). Therefore, the APEX team's survey technique employed all three methods.

In order to obtain the appropriate information for this handbook, a literature search of DoD studies on improving

the acquisition process and ATF SPO documentation and a consensus survey, in the form of interviews, were required. According to Emory, this information could be obtained by the use of a literature search or the survey method (28:158).

Identification of Population

It was necessary to identify individuals in the ATF SPO, the User, civilian contractors, and the APEX team who were familiar with the ATF ESC strategy and user-interface process. Unstructured personal and telephone interviews with ATF SPO and APEX team personnel aided in the identification of the appropriate population. Specifically, the ATF SPO TAC Liaison Officer (TACLO), the Chief of the ATF SPO Tactical Requirements Branch, and the Chief of the ATF Strategies Branch, assisted in this process.

The ATF SPO population of interest included the ATF director, the chief engineer, the deputy director, the assistant director, and the directors and branch chiefs of Logistics, Projects, and Engineering. Additionally, all the people directly involved with the ATF ESC strategy and process in the ATF SPO were also interviewed.

The user population of interest includes the ATF TAC Liaison Officer, the ATF Deputy Program Manager of Logistics, the ATF ATC representative, and all other user personnel collocated in the ATF SPO. In addition, user

personnel fron TAC/DRB, who were directly involved with the ATF approach, were interviewed.

The contractor population was defined as the focal point for the various activities associated with the ATF approach. The ATF contractors included the four prime contractors who participated in the ATF D/V phase. These people were chosen because of their familiarity with the techniques used in the ATF user-interface process. Moreover, they participate in the performance trades process.

Finally, the APEX team population included AFSC, SPO, and TAF-user personnel that were part of the user team. This team actually interviewed the program managers and functional experts during the evaluation.

The APEX Evaluation

Hundreds of interviews were conducted by APEX team members to identify no-value-added tasks associated with the acquisition of weapon systems which could or should be deleted or improved (15). Program directors, project managers, industry, users, functional organization personnel, and acquisition executives from qther services were interviewed by the team interviewees (15). In addition to the perceived problems and problem areas, more than 300 improvement ideas were identified.

The APEX team concluded, in part, that SPOs needed to develop a better interface process with their participants,

including the user, particularly in the early phases of the acquisition process (15). Also, the study identified a number of concern areas associated with the requirements generation process which every SPO-user team-building strategy should consider. They were (16):

Good Cooperation and Exchange of Ideas. The program director and his user counterpart must create an environment of openness and trust. They must be committed to the establishment of an effective SPO-user team process. They must also ensure that the personnel responsible for implementing the user-interface strategy have the necessary guidance. The user must be integrated into the acquisition strategy, and be involved in every aspect of the program.

Disciplined Requirements Generation. The user believes the requirements definition process should be separated from the Planning Programming and Budgeting System (PPBS) process. The requirements process is set up to make informed cost-schedule-performance-tradeoffs at critical points during the acquisition process. Whereas, the PPBS typically is not set up to make informed affordability assessments and resource allocation decisions on defense acquisition programs. Moreover, SPO analysis techniques do not adequately reflect cost and schedule constraints. Also, the user feels that AFSC needs to commit to Preplanned Product Improvement (P3I) programs earlier in the acquisition cycle.

Team Approach. The SPO user-interface strategy should consider a team acquisition strategy throughout the life of the program. The user should be involved in the day-to-day decisions. The team should operate with complete candor. Finally, the user needs to be better educated in the acquisition process.

Mission Area Analysis/Cost of Operational Effectiveness Analysis (MAA/COEA). Historically, AFSC has not committed the necessary resources to execute this analysis. Moreover, the user has been excluded from this analysis.

Concept DIR Studies. This concern is not applicable to this study.

Approach to Major and Non-Major Programs. This concern is not applicable to this study.

Exclusion from Acquisition Process. Typically, when the operational needs are identified, the user does not remain a responsible and useful partner in the development and acquisition process. Ideally, the user must be involved in every program action to ensure the TAF is provided with the best operational capabilities.

Improved Synergism of Documentation. A strategic plan needs to be developed up front to synergise all applicable program documentation. This includes clear system definition, a threat baseline, and standard simulations. It is critical that the system specification must be traceable

back to the system requirements and the Operational Requirements Document (ORD) through the trade studies. Also, the ORD should be updated after every major trade or program action rather than at every major milestone. All this is key to having accurate and timely information available whenever it is needed.

Handbook

Typically, AFSC program managers and SPO personnel do not have proper guidance, experience, or knowledge, to integrate the user into the acquisition process. Therefore, the ATF-based ESC interface process handbook was written for all AFSC program directors and managers. The handbook could also be useful to SPO and user personnel who are responsible for planning, implementing and executing their program manager's user-based interface process.

Literature Review

The literature review provided the initial background information on the ATF strategy and the corresponding user-based process. Specific engineering and management techniques developed by the ATF SPO and the user which would improve communication and, therefore, the contributions were initially identified and documented in the handbook under the APEX concern areas. According to Business Research Methods, by Emory, valuable background information is acquired through a literature review (28:135-155).

Interview Approach

The interviews allowed for more detailed and in-depth study of the subject, and they obtained essential information that was needed to write the handbook. Also, through the interviews, it was possible to identify possible improvements to the ATF ESC process.

The unstructured interview was used in this study because of its flexibility. Even though a statistical analysis was not done, this type of interview enabled verbal communication between the researcher and the person being interviewed. Another benefit of the unstructured interview was that verbal communication allowed misunderstandings or ambiguities to be resolved during the interviews. The opportunity to clear up ambiguities was highly desirable because of the unique nature of this study.

The most serious shortcoming of any interview is the amount of time required to contact and interview the necessary people. Thus, because of time constraints, the number of people who can be contacted and interviewed is limited. This time constraint was further complicated by the fact that most of the user and APEX personnel were not located at ASD. In some instances, there was no alternative but to do a telephone interview and coordinate the results with the interviewee after they were drafted.

Interview Construction and Administration. The investigative questions were developed to enable the study

to not only document the ATF ESC process, but possibly improve it. In order to answer the six investigative questions and obtain the information for the handbook, a subgroup of the sample was interviewed for each investigative question.

Investigative Question One. What factors caused the ATF SPO to develop the ESC interface process process with the User? The ATF SPO Director, the ATF Deputy Program Director, the Assistant ATF Program Director, the Deputy Chief of Staff, Tactical Air Command, and the APEX committee chairperson were interviewed to answer Question 1. Several of these people are located in Washington D. C., so TDY travel was required.

Investigative Question Two. What changes were required in the ATF SPO's acquisition strategy to support the ATF ESC interface process with the User? The ATF Program Director, the ATF deputy program director, the Assistant ATF Program Director, the ATF Director of Projects, the Chief, Plans and Strategies Division, ATF SPO, HQ USAF, and HQ AFSC were interviewed to answer Question 2, Question 5, and Question 6.

Investigative Question Three. What engineering and management techniques were developed by the ATF SPO for the ESC interface process with the User? The whole sample was interviewed to answer Question 3.

Investigative Question Four. How can these engineering and management techniques be generalized and applied to other major Air Force acquisition programs? The whole sample was interviewed to answer Question 4.

Investigative Question Five. Into which acquisition phase should the program director implement the ATF interface process with the User? The ATF Program Director, the ATF deputy program director, the Assistant ATF Program Director, the ATF Director of Projects, the Chief, Plans and Strategies Division, ATF SPO, HQ USAF, and HQ AFSC were interviewed to answer Question 5.

Investigative Question Six. What approval cycle is required to implement the ATF ESC interface process with the User? The ATF Program Director, the ATF deputy program director, the Assistant ATF Program Director, the ATF Director of Projects, the Chief, Plans and Strategies Division, ATF SPO, HQ USAF, and HQ AFSC were interviewed to answer Question 6.

Depending on the progress of the handbook, additional research and interviews may be required to understand the process of validating a handbook. A sample of all these people, including Major Stibravy, Dr. Shane, and Captain Daley (AFIT 90S graduate), will be interviewed to answer Question 4.

Chapter Summary

The purpose of Chapter II was to present the research methodology for answering the investigative questions and addressing the specific APEX concern areas. The population was identified, including the validation method. The measurement instruments, literature review, and interviews, were identified, and the specific procedures for conducting the interviews were discussed. The literature review will be discussed in more detail in Chapter III.

III. Literature Review

Introduction

The purpose of this chapter is to examine literature related to the acquisition process and the TAF requirements process within industry as well as the government to provide a better understanding of weapon system acquisitions. In addition, this chapter began documenting some of the ATF ESC user-interface concepts. The first section provides a brief overview of the Acquisition process, TAF requirements process, and TAF requirements management responsibility. Specific relationships were also discussed under management responsibilities. This included: TAC/TAF relationship, program objectives memorandum (POM)/budget submission estimates (BES) involvement, AFSC, AFLC, and contractor relationships. The second section reviews and outlines some of the concepts associated with the ATF ESC user interface process. Finally, the third section reviews three studies conducted within AFSC that apply specifically to the topic of research.

Scope of the Research Topic

Research on the subject of SPO-user relationships during the requirements process included a search of the literature listed in DTIC and professional journals within the libraries of AFIT and Wright State University. In addition, knowledgeable people within the area were sought

and asked about published or unpublished literature that would be applicable to this study. These sources included the ATF SPO, ATF TACSO, ATF Director of Projects, TAC/DR, and various personnel from the APEX team.

Discussion of the Literature

General Randolph, former commander of Air Force Systems Command (AFSC), spearheaded an initiative in 1989 that sought out ways to improve the current acquisition process. Major changes were required because of today's environment of declining resources and clear emphasis on technological solutions to our nation's defense needs (15; 39). This initiative later became known as APEX. The mission of APEX was to create a revolutionary team acquisition process that destroyed barriers, inspired opportunity for improvement, and increased responsiveness to the user (15).

During the APEX team's data collection phase which consisted of surveying program managers and functional experts across the Command, recurring inputs on perceived acquisition problems centered on ways to improve the relationship between AFSC and the user (15). One of the most promising recommendations from the APEX team's initial study was the Early Acquisition Strategy, which placed the user instead of AFSC in charge of the Concept Exploration/ Definition phase.

The ATF SPO developed a similar process for improving the relationship with the User, the Early, Structured, and

Continuous (ESC) user-interface process, in the Demonstration/Validation phase of the program. The goal of the process was to make the User an accountable team member, and to educate the User to ensure the requirements were stablized as early as possible in the acquisition process. This process improved the way in which the SPO/contractor/user team refined the initial requirements through the trade study process.

Major Systems Acquisition

Most new development programs go through a sequence of key program decision milestones and activities known as the acquisition process or system acquisition life cycle. The system acquisition life cycle is essentially a logical flow of activity representing an orderly progression from concept formulation to final operational deployment and support (37:258). Outputs of each phase constitute a definite and documented baseline for entry into the next phase. The life cycle also represents an incremental commitment of resources. As the system evolves, each decision milestone is directed to commitment of increased resources predicted on achievement of well-defined objectives. The milestone objectives are designated to reduce the risks (cost, schedule, and technical) inherent in a new acquisition through demonstrated performance, thus enabling acquisition programs to progress to completion or be terminated (37:258).

Definition of Major System. The SECDEF designates those programs that are to be managed as major systems. Normally, this is done when the system is first authorized (MNS is approved). The decision to designate those systems as major may, after consultation with the USAF, be based on the following (43:Chapter 5,1):

1. Development risk or urgency of need.

2. Joint acquisition of a system by the DoD and representatives of another nation, or by two or more DoD components.

3. The estimated Research Development Test and Acquisition (RDT&E), procurement, operations and support costs (rule of thumb is $200M in RDT&E or $1B in procurement funds).

4. Significant Congressional interest.

Initial SECDEF Approval. Systems acquisitions are based on operational needs identified through continuing analysis of missions. The Statement of Operational Need (SON) or Mission Need Statement (MNS) must specify the need narrowly enough to allow a reasonable probability that a single system can correct the deficiency without identifying specific hardware solutions (43:Chapter 5,3).

Each major system acquisition program requires a MNS to be reviewed by OSD in the POM review before the program is included in the DoD budget submission. When the MNS is sent to OSD, they must contain recommendations and rationale for designating the program a major program.

The SECDEF approves the new start via an Acquisition Decision Memorandum, which authorizes the start of the acquisition process and entry into the Concept Exploration/ Definition phase.

Following SECDEF approval, HQ USAF provides formal direction to the implementing and participating commands by issuing a Program Management Direction (PMD). The PMD is used throughout the entire acquisition life cycle to state requirements and request studies as well as initiate, approve, transfer, modify, or terminate programs.

TAF Requirements Process

The ATF ESC interface process was implemented without changing the TAF requirements process or the TAF requirements process management responsibility. These processes provide the means to identify operational deficiencies, state operational needs, and initiate development of new (or improvements to existing) systems and equipment.

Deficiencies in force capabilities may be identified through Mission Area Analysis (MAA). Operational deficiencies which cannot be satisfied/corrected within the command's authority must be identified, quantified, and submitted to HQ USAF (37:301). The statement of deficiency or need is done by the Statement of Operational Need (SON) in accordance with AFR 57-1, Operational Needs,

Requirements, and Concepts. At this point, TAC/DR becomes the responsible TAF agency for the remainder of the TAF requirements process.

Following SON validation, or SECDEF approval for major systems, a PMD is issued by HQ USAF. In addition, TAC DCS/Plans provides Preliminary System Operational Concepts (PSOCs) and System Operational Concepts (SOCs) on candidate solutions to SONs (43:Chapter 5, 3-6). These documents describe the intended purpose, employment, deployment, and support of a system.

Requirements Management

TAC/DR maintains close contact throughout the entire acquisition process from program initiation to production and deployment and operational support (43).

To provide single, cohesive, and responsive focal point for TAF modernization, the Deputy Chief of Staff (DCS) Requirements was established (43).

TAC/DR is subdivided into six directorates and three major Special Management Organizations (SMOs) to work and manage programs. To assist DR in its management function, the Liaison office was formed. DR has eight liaison offices located at selected Air Force activities, primarily AFSC divisions. They serve as the TAF representatives and play a major role in their management of TAF requirements.

TAF/TAC Relationship. TAC/DR is designated the requirements spokesman for the TAF (TAC, USAFE, PACAF)

throughout the development and acquisition process (43). They perform the administrative functions of coordination, justifying, and presenting TAF requirements.

POM/BES Involvement. Another key aspect of TAC's involvement in the requirements process is their attempt to influence the formulation of the POM/BES to ensure that TAF's most urgent needs are funded (43).

TAC POM working groups, with DR representatives and/or chairmen, are critical elements in the efficient and effective production of a prioritized listing of TAF RD&A programs for submission to Air Staff for their use during POM formulation (43).

Testing Responsibilities. Testing is another vital ingredient in a successful acquisition program. There are two types of testing associated with acquisition: Development Test and Evaluation (DT&E) and Operational Test and Evaluation (OT&E). DT&E is normally performed by AFSC. TAC/DR is the responsible staff agency for all OT&E conducted within the command.

Relationship with AFSC. TAC/DR is deeply involved with AFSC because they are responsible for the development and acquisition of weapon systems and support equipment that are responsive to the needs of the TAF (43:Chapter 5,17). It is important that TAC/DR and AFSC work closely throughout the acquisition process.

Relationship with AFLC. TAC/DR is also involved with AFLC on programs which modify inventory systems and support equipment (43:Chapter 5,18).

Relationship with Contractor. TAC/DR has frequent contacts with contractor representatives, and it is important that they understand what the Air Force expects that relationship to be (43:Chapter 5,19).

Overview of ATF Program

The ATF is being developed as an air superiority fighter to dominate the threat in 2000 and beyond with a primary design mission of offensive counterair (13). Developing a system with improved performance characteristics such as supersonic persistency, high maneuverability, and better combat radius, with goals for a 50,000 pound aircraft at $35 million average unit flyaway cost (base year '85 dollars) was a challenging task requiring optimization of numerous variables which must be treated in an integrated analysis (13). The program is currently in a competitive D/V phase and will enter FSD in mid-1991. Production options are scheduled to be exercised beginning in 1996 with TAF receiving aircraft beginning in 1999 (13).

ATF ESC User-Interface Process

User-Interface Philosophy. This section discusses some of the management and engineering techniques developed by

the ATF SPO that an acquisition program can use in the D/V phase to help ensure the operational requirements are met. The user was involved in every aspect of the program to ensure operational requirements become an integral part of the weapon system design process. Representatives from the TAF, AFLC, and ATC, for the ATF, were collocated in the program office and treated as members of the SPO. There were no formal agreements between the SPO and the User, since senior Air Force management supported the approach. The ATF SPO established teams of O&S and MPTS experts within the SPO to ensure these requirements were integrated into the system design. For example, the ATF user-interface approach for MPTS was as follows:

> In the past MPTS has been an analysis activity that takes the results of a design process to find an MPTS answer to a fixed design. MPTS analysis must be applied through the design process so that the result is a balanced weapon design that includes an optimized MPTS solution. (13)

The user attended working groups, Technical Interchange Meetings (TIM), program reviews, and briefings at all levels. The user participated in MAA/COEAs and ATF-alternative studies. The program director briefed the TAC commander every six months on the status of the weapon system design. He also effectively used a direct line to the TAC Commander, through TAC/DRB, which was exercised even more frequently due to the priority of the program and the political sensitivity.

ATF Threat Baseline. The program director ensured the user was involved in the process of baselining the threat description. A standardized threat description was critical for several reasons. First, the competing contractors had to be evaluated from a common baseline. Second, a standard, coordinated threat baseline helped to defend the program in the annual program reviews and alternative fighter studies. The ATF SPO went to great lengths to accomplish the necessary coordination as indicated in a letter from the Air Force Chief of Staff:

> The Air Force ATF decision-making community from the SPO to the Secretary needs a known, documented, authentic baseline threat and model. For example, the contractors need a coordinated, definitive baseline threat from AF/IN (DIA certified) and AF/SA needs to control and operate a baseline model so as to make the contractor variants either conform or be visibly not in conformance. (36)

The ATF SPO established a Threat Working Group (TWG) with a charter that ensured that: (a) the baseline was established, (b) the contractor conformed to the threat description, and (c) the baseline was periodically updated. Participants from every applicable Air Force organization participated in this group.

Contractor Trade Studies. The trade study process was critical in refining the requirements, reducing risk, and ensuring the data was traceable and justifiable. The process can be described as follows:

> This process includes acquiring sufficient data to make requirements decisions and maturing technologies with which to enter FSD, both risk reduction activities.

> This is an iterative process in which the SPO provided the contractors a system requirement against which the contractors are applying trade studies and demonstration tools, returning recommendations for changes to the requirement for better system optimization. These requirements recommendations were analyzed by the Air Force. Accepted recommendations are documented in the system specification and returned to the contractor as new requirements. This cycle was repeated annually during the D/V phase. (1; 34; 40)

The process results in a match of requirements and available technologies to baseline an executable program at FSD (1). This led to an unprecedented technical understanding of the requirements and a complete traceability to the original requirements. Cost was factored into requirements trades. This process identified the requirements that had to be flight tested in D/V. The program entered FSD with low to moderate program risk in all areas. The TAC Commander reviewed the status of the contractor trade studies on an annual basis. This review required unparalleled teamwork between the SPO, user, contractor, and other government organizations. In short, the user had a willingness to adjust his requirements based on the contractor trade studies which demonstrated technical feasibility.

System Design Concept. The ATF was designed primarily for a single mission requirement-offensive counterair. The design philosophy stressed utilization of state-of-the-art technology and the descriminate application and tailoring of military standards and specifications (37:293). Another objective of ATF D/V was to force integration of

supportability and MPTS requirements into the weapon system design and deliver a plan that ensured these requirements were met (13). Normally, supportability and MPTS take the results of the design process to find a supportability and MPTS answer to a fixed design (13). The ATF SPO ensured this design concept was adhered to with the following process:

> The government process includes assembling a team with MPTS experts within the SPO to work MPTS requirements. This MPTS team can be extended to Training Planning Teams (TPT), expanding the scope of TPTs and providing a forum for MPTS discussions. (13)

The SPO had the same philosophy and approach in considering supportability requirements. This review did not address the corresponding contractor process and the relationship between the government and contractor processes.

Budget Model. Affordability was a major program driver in the annual review process and forced discipline in the system. A relational, detailed budget model was developed to validate the contractor data in relative terms and cost the proposed configurations as they were developed. This model was developed from Air Force and contractor data (23; 35).

SORD. The System Operational Requirements Document (SORD) was updated annually instead of at major milestones. This ensured that the system specification and SORD were consistent.

Working Groups. Working Groups were established for weapons integration, avionics, cockpit, training, supportability, safety, and test and evaluation. These groups consisted of representatives from the government and contractor organizations, chaired by the ATF SPO management, and met as required to assist in the development of an integrated weapon system design (3; 4; 5; 11; 12). For example, the user inputs to the Threat Working Group helped in validating astandardized threat baseline for use by the contractors and TAC. Pilots' participation in the Cockpit Working Group improved understanding of the man-machine interface (42)

Weapons Integration. Munitions System Division (MSD) established an operating location within the ATF SPO to ensure a balanced weapon system design. A Memorandum of Agreement specified the required support (8). The MSD representative was critical in providing baseline weapons data to ensure total weapon system integration, and ensured armament program cost, schedule, technical, and program direction was consistent with the ATF program. The ATF SPO prepared a Weapons Integration Plan which was a major tool of the Armament Integration Working Group, and ensured the ATF design was a weaponized design.

Engine. The engine program was a separate program from the weapon system. However, the ATF SPO controlled the engine program which is normally managed by Deputy for Pro-

pulsion, Aeronautical Systems Division, ASD/YZ in other aircraft programs. These personnel were located in the ATF SPO and reported directly to the Program Director. This approach gave the Program Director complete control of the D/V process.

Avionics. The ATF SPO controlled the technical support out of Deputy for Reconnaissance and Electronic Warfare, Aeronautical Systems Division, ASD/RW, which is normally collocated from ASD/RW. ASD/RW provides avionics technical support. These personnel were located in the ATF SPO and reported to the program director.

Interface with the Prime Contractors. The contractors participated in the development of the threat description. They were active members of the various working groups. They provided the required data and performed the necessary trades. They provided cost data for the Air Force budget models. They generated the appropriate data for the various reviews which was used "as-is" in briefings to the highest levels in DOD (1).

Integrated Process Team. Although IPDs were not formalized until FSED, they were used, informally, by the O&S team of experts to involve the engineers in their meetings, or solving their problems (33; 38).

Acquisition Process Excellence (APEX) Study

The APEX committee was established by General Randolph as a follow-on study to the SPO Sizing Phase I initiative.

There were four objectives of the initial APEX study. First, the study attempted to baseline the entire acquisition process from SON to Program Management Transfer Responsibility (PMRT), and maintain/update as improvements/ streamlining to the acquisition process were identified (15). Second, it analyzed subprocesses within the acquisition process and recommended improvements (15). Third, the study identified methods to streamline the acquisition process (15). Fourth, it identified SPO core tasks, assigned priorities, and defined the organization primarily responsible for the task as well as those having collateral responsibility (15).

The study was completed in March 90. A major accomplishment of the APEX team was the completion of the acquisition flowchart which baselined the current acquisition process. Also, more than 320 improvement ideas were identified from interviews with program directors, project managers, industry, users, functional organization personnel, and acquisition executives from other services (15). As these improvement ideas were identified, the acquisition flowchart was updated by ASD/XRM. APEX developed a quality function deployment action plan for (1) developing/fielding SPO manpower models; and (2) accomplishing streamlining within a defined AFSC Total Quality Management (TQM) structure (15). The APEX team also made two recommendations as a result of their initial study.

First, the team recommended some significant changes to the way a SPO manages a contract, but they had little bearing on the topic of research (15). Briefly, the team felt that AFSC spent significant resources reviewing and approving lower-tiered specifications and other documents, and intervening in solving contractor problems (15).

The second recommendation, titled Early Acquisition Strategy (EAS), is directly related to the topic of research. Based on the APEX team's evaluation of the current acquisition process, the EAS was developed as an alternative user-interface strategy to address the study objective:

> The current process of developing acquisition strategies lacks a consistent, systematic approach, is not responsive to the user, does not comprehensively address program risks, and results in a lack of corporate commitment and inexecutable program. (15)

The EAS placed the user in charge of an acquisition team in the CE/D phase to ensure the concepts of operation are fully developed before the technical solution is pursued in D/V and FSD (15). Expanding on this approach,

> The concept depends heavily upon a standard Air Force team approach to conducting acquisition programs. All Air Force MAJCOMS must have a common understanding so that an effective team is formed to satisfy the using command's need for an operational capability. The user should lead the Air Force team during both the requirements definition process and the concept exploration phase, conducting concept direction studies, evaluating and prioritizing alternative solutions, and advocating the program to the PDA. This could be accomplished using an organization such as an Acquisition Support Group (ASG), chaired by the user and established prior to milestone 0. (15; 32; 39)

HQ AFSC XR is responsible for implementing this strategy, but the development of this concept is still in the early stages.

The APEX accomplishments along with the implementation plan for the EAS and contractor accountability recommendations provide the mechanisms for achieving the Air Force goal of a streamlined acquisition process and a means to define manpower requirements and allocate resources (17).

APEX II

A follow-on streamlining initiative was chartered by General Teal, Vice Commander of AFSC, in June 1990, to demonstrate the feasibility of efficiently identifying acquisition process opportunities. The following redefined goals were developed (15):

1. Baseline the existing program office acquisition processes and update as the process is improved.

2. Develop metrics that allow measurement of each process and knowledge when improvements have been made.

3. Provide each field commander with visibility into those processes by developing "benchmarks" for those processes.

4. Share with all of AFSC the best practices found anywhere in the acquisition community.

The overall results of achieving these goals will be more and smarter streamlining decisions as visibility into the acquisition process becomes clearer with development of the acquisition baseline, useable metrics, and benchmarks (15).

Government Crew System Development Study

The purpose of this study was similar to the first objective of the APEX study which was to develop a set of core tasks for acquiring a weapon system from SON submittal to PMRT (14). The responsible government office is the CAT ADPO which is located at WPAFB. This study applied to new, major weapon system programs. This study was useful for two reasons. First, the contractor performed an extensive literature review to determine what Air Force documents and policies may be affected by changing the acquisition process. Second, the contractor used the ATF program to help define the acquisition players and core tasks, within a program office, for acquiring a weapon system.

Chapter Summary

The purpose of Chapter III was to present a few major topics in the literature related to the acquisition process. The literature covered R&D organizations in general as well as a review of three related studies pertaining to improving the acquisition process within AFSC.

Initially, it was necessary to familiarize the reader with the objectives, organizations, and key players and relationships in the acquisition process and TAF requirements process. The TAF requirements process is a subprocess of the acquisition process.

In section II, potential improvement activities associated the ATF ESC user-interface process were identified and discussed.

Finally, in section III, Phase I and Phase II of the APEX study and an ASD study were reviewed.

The initial APEX initiative identified numerous problems with the way AFSC and the user interface in the early stages of the acquisition cycle, as viewed by program managers, functional experts, users, and service acquisition executives. However, their Early Acquisition Strategy approach is really limited to the CE/D phase.

The follow-on APEX initiative, APEX II, concentrated on demonstrating the feasibility of efficiently identifying process improvement opportunities.

The CAT study really did not apply to the topic of research. Essentially, a local contractor has developed a model for defining SPO manpower requirements and tasks and allocating SPO resources.

The next chapter will discuss the findings of this study.

IV. Analysis of Data

Introduction

Since the objective of this study was to document an existing process, the ATF ESC user-interface process, in a draft handbook, there was no need to analyze any data. Senior Air Force management, recognizing the need for better communication between the SPO and the User, directed the ATF SPO to develop an user-interface process which would improve the effectiveness of the D/V phase (1). The ATF ESC interface process with the User has been in operation for four years, and it has been accepted by all of the participating organizations. Upon completion of the research process, however, there were several items of interest that need to be discussed.

Acquisition Process Excellence (APEX) Study

The study criteria as well as the general and specific problems were defined and validated, using the survey method, by the APEX evaluation of the current acquisition process. The criteria for improving the relationship between the SPO and the User were: cooperation and exchange of ideas, disciplined requirements definition, team approach, exclusion from acquisition process, and improved synergism of documentation (16). ATF SPO management was aware of the APEX initiative, but the concepts associated with the ATF ESC interface process with the User were

developed before it began. The management and engineering techniques associated with the ATF user-interface approach did, however, fall under these five areas of concern.

APEX II

The APEX committee continues to work with functional experts and program managers throughout the Command to identify the "best practices" in any acquisition program to enhance the acquisition process. This follow-on initiative was called APEX II. This study, or a follow-on effort from this study, could be pursued through the APEX II initiative.

Government Crew System Development Study

The objective of this study was to develop a SPO team-building model for organizing and identifying specific responsibilities and functions within a SPO (14). The study really produced an organizational development model. It could also be used as a training tool for new SPO members. Although the ATF SPO developed some unique organizational techniques associated with the ATF ESC user-interface process, the model was not used in this study.

F-15 Program

Major Gilbert B. Guarino wrote a paper on lessons learned from the F-15 program (37:290). In fact, the ATF SPO used several F-15 management and engineering concepts, such as collocating User-representatives within the SPO, early User involvement, and system definition and design, in

its user-interface approach (37:293). However, the F-15 approach was used in the CE/D phase (37:293).

ATF ESC Interface Process With the User: Improvements

Generally, the User was very pleased with the ATF ESC user-interface process. There were a couple of items that the User felt needed improvement. They were training and the number of User personnel in SPO.

Training. Grade restrictions prevented enlisted personnel from acquiring the necessary training for acquisition related work (30; 31). This appears to be an Air Force problem. The SPO can, however, improve the training process within SPO through constant communication, SPO libraries, and acquiring User personnel with acquisition experience.

Number of User Personnel. ATF SPO management and the Deputy Program Manager for Logistics (DPML) attempted to acquire an O&S expert for each operational Air Force Specialty Code (AFSC) (30; 31; 38). If successful, they would need ten O&S experts. Although the ATF SPO used three O&S experts, in addition to the two User-representatives, these experts were still overworked.

Chapter Summary

The User was extremely satisfied with the ATF ESC interface process. The User had two concerns with the ATF user-interface approach (training and the number of User

personnel assigned to the SPO), but they were really not SPO problems. In addition, the ATF ESC user-interface process was developed before the APEX initiatives, or other acquisition improvement efforts began. Finally, the ATF ESC user-interface process was developed primarily from lessons learned on past programs, and specific direction from senior Air Force leadership (1; 35; 41; 46). The ATF ESC process was successful due to the personalities of the ATF SPO leadership and personnel (1).

V. Conclusions and Recommendations

Introduction

The purpose of this chapter was to discuss specific conclusions and recommendations from the study. The conclusions and recommendations were not very general because of the nature of the study and its limiting assumptions. The conclusions will be discussed, first, followed by the recommendations.

Conclusions

The study found that the ATF SPO ESC user-interface process was used to ensure that the trade study process resulted in a match of requirements with achievable technologies to baseline an executable program by FSED (1). The process was pushed by senior Air Force leadership. Its concepts were based on lessons learned from past programs and innovative management techniques.

The team-building process was critical in the D/V phase because participants, such as the O&S personnel, MPTS personnel, and manufacturing personnel had the greatest opportunity to integrate their requirements into the system design (23).

In addition, the ATF ESC process concepts could be applied to every major program in the D/V phase. The process could also be implemented within the guidelines of the current Air Force acquisition process. It does not

change the roles and responsibilities of the SPO, the User, the contractor, or the other participants. It was also used without any formal agreement, such as an MOA, between the SPO and the User.

This briefly summarized the conclusions from the study. The following paragraphs cover them in more detail by answering the investigative questions.

Investigative Question I. What factors caused the ATF SPO to develop the ESC interface process with the User? The following factors, senior Air Force management guidelines, lessons learned, and SPO management direction contributed to the development of the ESC user-interface process (1). Each factor is discussed, separately, next.

Senior Air Force Management Guidance. The commitment by senior Air Force management to execute the ATF system definition and design concepts, and integrate the User, early, in the acquisition process was crucial to the success of the ATF ESC user-interface process (1). The Air Force Chief of Staff, TAC Commander, AFSC Commander, ALD Commander, and SPO director were all committed to creating an environment of openness and trust. The SPO director and his User counterparts managed to create an environment of openness and trust through many innovative management and engineering techniques which will be discussed shortly.

Lessons Learned. Based on lessons learned from other programs, it is easier and less costly to integrate

manufacturing, supportability, maintainability, and cost into the initial design while it is evolving (1). This can avoid costly weapon system modifications and upgrades at a later date. In order to accomplish this, the SPO recruited program managers, engineers, and maintainers with recent experience in the weapon system being acquired. They were placed in key management and engineering positions. User representatives were also brought into the SPO at the beginning of D/V. In addition, the maintenance personnel were given the latitude (including TDY funding) by management to acquire the necessary support from any expert within DoD and the defense contractors in the required discipline areas, such as ATF Integrated Maintenance System (AIMS) and the Integrated Maintenance Inspection System (IMIS) (30; 33; 38). Also, User participation in the PMRs, working groups, and technical meetings was part of the education process, and was crucial to a program's success.

SPO Management Direction. The SPO director pushed the use of state-of-the-art technology and discriminate application and tailoring of military standards and specifications (30). For example, the SORD was updated, annually, rather than at the end of the D/V phase. Test Information Sheets (TISs) were required at least a year in advance of the specific test date instead of 30-45 days in advance. This ensured that the test objectives were clearly stated, and that they could be traced back to a specific

requirement in the SORD. Also, the SPO director desired 100 percent commonality and interoperability between the ATF support equipment and standard Air Force equipment (35).

Investigative Question II. What changes were required in the ATF SPO's acquisition strategy to support the ATF ESC interface process with the User? Innovative management concepts, such as the use of a baseline threat description, a baseline TAC BRAWLER effectiveness model, a relative cost model, Man-In-The-Loop (MITL) simulators, Type III mockups, prototypes and discriminate application and tailoring of military standards and specifications, changed the acquisition strategy (1; 20; 21; 30; 33; 38; 40). Each of these, however, were discussed in more detail in order to answer Question 3.

Investigative Question III. What engineering and management techniques were developed by the ATF SPO for the ESC interface process with the User? The techniques will be discussed under the appropriate concern area identified by the APEX committee survey. They were: cooperation and exchange of ideas, disciplined requirements generation, team approach, exclusion from acquisition process, and synergism of documentation (15).

Cooperation and Exchange of Ideas. The following concepts were used by the ATF SPO to ensure good cooperation and exchange of ideas with the user.

Management Commitment. The commitment by senior management to execute the ATF system definition and design concepts, and integrate the User, early, in the acquisition process was crucial to the success of the ATF ESC user-interface process (1). The Air Force Chief of Staff, TAC Commander, AFSC Commander, ALD Commander, and SPO director were all committed to creating an environment of openness and trust. The SPO director and his User counterparts also managed to create an environment of openness and trust because of their personalities and innovative management techniques (1).

Early User Involvement. Based on lessons learned from other programs, it was easier and less costly to integrate manufacturing, supportability, maintainability, and cost into the initial design while it was evolving (1). In order to accomplish this, the SPO recruited program managers, engineers, and maintainers with recent experience in the weapon system being procured. They were placed in key management and engineering positions. User representatives were brought into the SPO at the beginning of D/V. The maintenance personnel were given the latitude (including TDY funding) by management to acquire and use any expert within DoD and the defense contractors in the required discipline areas, such as AIMs and IMIS (30; 33; 38). Also, User participation in PMRs, working groups, and

technical meetings was part of the education process, and was crucial to a program's success.

Organizational Techniques. The ATF SPO employed some unique organizational techniques to maintain control of the program and the funding, and to remain a credible counterpart to the user. These techniques were:

User Representatives. User representatives from ATC, AFLC, and TAC should be collocated in the ATF SPO.

O&S/MPTS Experts. The DPML attempted to acquire maintainability experts for each operational AFSC (30; 33; 38; 41). The SPO director assembled a team of training experts within the SPO. The team consisted of ASD/RW, Training System Office (TSO), engineers, and ATC User-representatives.

Experienced SPO Personnel. Pilots, trainers, and maintainers, with current and extensive background in weapon system being procured, occupied key engineering and management positions in the SPO.

Engine Responsibility. The engine program is generally a separate program from the weapon system. However, the SPO controlled the engine program which is normally managed by Deputy for Propulsion, Aeronautical Systems Division, ASD/YZ in other aircraft programs. The personnel were relocated in the SPO and reported directly to the Program Director.

Avionics Support. The SPO also controlled the technical support out of the Deputy for Reconnaissance and Electronic Warfare, Aeronautical Systems Division, ASD/RW. ASD/RW provides avionics technical support. The personnel were relocated in the ATF SPO and reported to the program director.

Laboratory Technology. The SPO signed Memorandums of Agreement (MOA) with all the Air Force laboratories. The ATF SPO established and controlled technology panels which met on a periodic basis and involved AFSC, AFSC product divisions, Air Force laboratories, User, ALDs, and flight test communities. The purpose of these panels was to identify any technology that may be applicable to the system. Many of these technologies and technology programs gave the SPO and the User better insight into potential Pre-Planned Product Improvement (PPPI) technology candidates for the ATF. The SPO also established a technology transition working group with the contractor to ensure the contractor was not duplicating the efforts of the Air Force laboratories. The contractors remained informed about technologies that could be used on the weapon system, but they were not allowed to use the lab efforts to justify the incorporation of technologies into the baseline through the trade study process.

Armament Integration. Munitions System Division (MSD) established an operating location within the

SPO to ensure a balanced weapon system design. A Memorandum of Agreement (MOA) was written to specify the required support. The MSD representative provided baseline weapons data to ensure total weapon system integration, and ensured armament program cost, schedule, technical, and program direction was consistent with the ATF program. The SPO also prepared a Weapons Integration Plan which guided the activities of the Armament Integration Working Group (ARWG). The ARWG ensured that the weapon system design was a weaponized design.

Training Planning Team. SPOs normally rely on MPTS support from the Training Advisory Office. On the other hand, the ATF SPO established a team of MPTS experts and collocated them in the SPO. The team established a Training Planning Team (TPT) to ensure that MPTS requirements were considered in the design process (41).

Maintenance Team. The ATF SPO used the same approach for the O&S requirements. They assembled a team of experts within the SPO. This team also developed a Maintenance Team (MT) to ensure that the requirements were considered in the design (30; 33; 38).

User Personnel Collocated in SPO. Although the primary interface was through TAC/DRB, collocating the User personnel in the SPO was helpful to the SPO when TAC/DRB could not be reached. They provided continuity

between the User and their SPO counterparts. They opened up the lines of communications, and ensured that the experts got involved (42).

TACLO User Representative. The TACLO was totally integrated into the SPO activities. He attended staff meetings, PMRs, technical meetings, and briefings. He participated in special studies, such as MAA/COEAs, SABs, and Multiple Aircraft Reviews (MARs), as required.

ATC User Representatives. The ATC User-representative was totally integrated into the SPO activities. He attended staff meetings, PMRs, technical meetings, and briefings. He participated in the TPT meetings.

AFLC User Representatives. The DPML, with support from the SPO director, attempted to assign a maintainability specialist to each operational AFSC (30; 33; 38). In addition, he assigned user representatives for each AFSC, or at least in the AFSCs that he is unable to fill with his own personnel (30; 33; 38). The O&S User-representatives were totally integrated into the SPO activities. They attended staff meetings, PMRs, technical meetings, and briefings. They participated in the TPT meetings.

Disciplined Requirements Generation. Disciplined requirements generation means integrating cost, MPTS, and O&S requirements into the system design while it

is still evolving. This required early integration of the User into the acquisition process, and educating the User (1; 34; 40). It resulted in a match of requirements and achievable technologies to baseline an executable program at the start of FSED (1). It also identified PPPI technologies, early, so that the weapon system was designed to defeat an evolving enemy (1). Moreover, it allowed the User to make informed decisions (1).

The ATF SPO used a common sense approach to system design and definition that required a level communication, openness, trust, and interaction between the engineers and the User that had never been achieved in the past. Some of the techniques used by the ATF SPO were as follows: understand the TAC requirements and use the best design philosophy to achieve them; educate and involve the User through the trade study process, Maintenance Team (MT) meetings, and Training Planning Team (TPT) meetings; direct the contractors to use the same analytical tools; ensure the Government was able to validate the Contractor's results; ensure the Government defined the mission scenarios and baselined a threat description; attempt to maintain commonality with existing O&S concepts; and, ensure that the Government and Contractor organizations developed supporting documentation (1; 20; 21; 30; 31; 33; 38; 40; 41).

System Definition and Design. The SPO focused the D/V efforts on a single mission requirement.

The SPO director pushed the use of state-of-the-art technology, and discriminate application and tailoring of military standards and specifications, if applicable (30). He also insisted on 100 percent commonality and interoperability with existing O&S and MPTS equipment and concepts. The trade study process required extensive interaction between the technical people and the User in order to match requirements with doable technologies (1).

Trade Study Process. The following process was employed very successfully by the ATF SPO, and resulted in a match of requirements and achievable technologies to baseline an executable program by FSED (1). It also identified PPPI concepts that were accounted for in the design. The process was as follows (1; 34; 40):

1. It started out with a number of generic concepts, based on the assumption that certain technologies would be available at the appropriate time, and broadly stated User requirements.

2. Then, the User choose a specific design concept.

3. And this was where the education process began:

   a. Through interaction between the engineers and the User, the User was educated on what was doable.

   b. Through analysis and testing, the engineers came up with design concepts, based on the broadly stated User requirements, and the associated cost, technical, manufacturing, MPTS, and O&S characteristics. The cost and technical data was derived from a relative sensitivity cost model and the TAC BRAWLER effectiveness model.

   c. Based on this, the User decided on the performance tradeoffs.

d. The above process was repeated with the SPO providing design alternatives with supporting data and the user making the performance tradeoffs.

4. The SPO also identified dates when the avionics, aircraft, and engine designs needed to be finalized.

5. The end result was a data base that matched requirements with doable technologies (with growth designed in for PPPI options) to baseline an executable program at FSED (1).

Integrated Design Approach. By integrating the trade study activities, with the test, O&S, and MPTS activities, the final design was not only achievable, but it was an integrated design. The ATF used the following concepts to achieve this level of design risk and integration.

Test Philosophy. Analysis and test played a crucial role in verifying and documenting the doable technologies as well as the potential PPPI technologies. The following test concepts were employed by the ATF SPO in the D/V phase of the program:

Team Concept. The test manager ensured that the User, Contractor, O&S, MPTS, AFOTEC, flight test center, and ALD communities were involved in PMR, working group, test planning, and technical meetings.

Test and Evaluation Master Plan. The test manager ensured that the User, Contractor, O&S, MPTS, AFOTEC, flight test center, and ALD communities were involved in the preparation and review of the Test and Evaluation Master Plan (TEMP).

Class III Mockups. Since the prototypes are, typically, not available until late in the D/V program, the contractor built Class III mockups for supportability and maintainability demonstrations and MPTS efforts (38).

"Fly-Before-Buy"/Prototypes. The SPO used a "fly-before-buy" approach by testing with prototypes before committing funds to FSED.

Avionics Flying Lab. The contractors used an Avionics Flying Lab (AFL) to test avionics design concepts not planned to be tested on the prototypes. The contractor also performed full-scale ground tests.

Ground Testing. The contractor used ground testing to test systems, subsystems, and components that were not tested on the prototype. Ground testing also supported flight testing, especially for the high-risk tests.

Test Information Sheets. The SPO required draft Test Information Sheets (TISs) on all tests to be delivered at least 12 months in advance of flight testing.

Engineering Review Teams. The SPO encouraged and supported independent Engineering Review Teams (EITs) for all test activities. The primary concern of these teams was to ensure that the testing supported

higher-level SORD requirements, and that it resulted in adequate risk reduction. SPO and User representatives attended these reviews as well.

Training Planning Team (TPT). The ATF SPO used a team of training experts within the SPO to ensure MPTS requirements were integrated into the design (41). They established a TPT to acquire inputs from experts throughout DoD and the defense contractors (41).

Maintenance Team (MT). The ATF SPO used a team of maintenance experts within the SPO to ensure O&S requirements were integrated into the design (30; 33; 38). They established a MT to acquire inputs from experts throughout DoD and the defense contractors (30; 33; 38).

Budget Model. A relational, detailed budget model was developed to validate the contractor data in relative terms, and cost proposed configurations as they were developed to match the latest set of requirements. The model was limited to just Air Force data. Contractor data was also used (23; 35).

MOAs and Working Group Charters. There were a large number of organizations supporting the program office. The program director ensured that these documents, if used, did not restrict or limit the technical support from the participating agencies.

Technology Transition. In order to minimize cost and properly integrate O&S and MPTS requirements into

the design, the SPO identified potential PPPI improvements as early as possible. These potential improvements were documented and tracked by a SPO manager using fact sheets. The SPO also established a Technology Panel and a Technology Transition Working Group to keep the Government and the Contractors informed about potential PPPI technologies.

Contractor Interface. The contractor was responsible for performing the trade studies. This process included acquiring sufficient data to make requirements decisions and maturing technologies with which to enter FSD, both risk reduction activities (13). This was an iterative process in which the SPO provided the contractors a system requirement against which the contractors applied trade studies and demonstration tools (13). The contractors then returned their recommendations for changes to the requirement for better system optimization (13). These requirements recommendations were analyzed by the Air Force. Accepted recommendations were documented in the system specification and returned to the contractor as new requirements. This cycle was repeated annually during the D/V phase. The contractor also participated in the TPTs, MTs, working groups, PMRs, and special studies. The contractor was an accountable team member. The contractor was also required to establish subcontracts and Associate Contractor Agreements (ACAs) with other weapon system

contractors, and develop draft Interface Control Documents (ICDs) for FSED.

Team Approach. In the case of the ATF program, a successful team acquisition strategy resulted from good communication and exchange of information and a disciplined requirements generation approach. The ATF used innovative management and organizational concepts in these areas as well as a team-acquisition strategy through working groups, PMRs, technical meetings, SPO maintenance teams, and SPO training teams. This was also accomplished without MOAs.

Exclusion from Acquisition Process. Two aspects of the ATF user-interface philosophy precluded the SPO from excluding the User from the acquisition process. First, SPO management believed that if the requirement was not in the SORD, then it was not a requirement (1). Second, the SPO believed that the trade study process was a education process which would help the User make informed decisions regarding the cost, schedule, and performance tradeoffs (1). The User was involved in staff meetings, program reviews, special studies, and technical meetings. On the other hand, the User-representatives felt they lacked the appropriate training before they entered the program office.

Synergism of Documentation. The following documents and analytical tools formed the database that was used by the SPO to answer inquiries, and to justify the requirements, the trade study results, and the PPPI

technologies. They also ensured that there was traceability throughout the program documentation as the requirements were being refined. Most importantly, they constituted the data base used to prove that there is a match between the requirements and the associated technology.

In order to accomplish these things, the SPO developed a matrix which cross referenced each requirement through all of these documents (38). In addition, the SPO established a group of people to periodically update the matrix, and ensure that the Preliminary System Specification (PSS) and the System Operational Requirements Document (SORD) matched one-for-one (38). The team included SPO, User representative, engineering, TAC/DRB, AFOTEC, HQ AFSC, SAF/AQL/AQR, ATC, and AFLC personnel.

SPO Library. The SPO was developing a SPO library. This library documented lessons learned, and was used to train SPO personnel and User-representatives, and to maintain continuity.

Program Management Direction (PMD). The User, HQ AFSC, and SAF/AQ representatives attended working groups, PMRs, and technical meetings. This enabled the SPO to get the proper direction, if required. The headquarters personnel communicated with the SPO on a daily basis, and came TDY at least once a month.

Preliminary System Specification (PSS). The SPO and the User ensured that the Draft PSS and the SORD matched one-for-one before the PSS was sent to the contractors. The SPO and the User periodically reviewed the PSS and SORD to ensure that they still matched. The PSS was also updated when the User made performance tradeoffs as described in the trade study process (23). In addition, the working groups, technical meetings, TPT meetings. and the MT meetings generated and documented proposed changes. These changes were eventually incorporated into PSS and SORD.

System Operational Requirements Document. The System Operational Requirements Document (SORD) was updated after each tradeoff decision point rather than at the end of D/V, or a milestone decision point (23).

Trade Study Results. The contractor referenced the PSS and SORD paragraphs for each requirement, or trade study initiative. The contractor developed control charts for each SORD and PSS requirement. These charts also delineated the risk reduction activities (analysis, test,..) required to reduce the risk of the technology to an acceptable level so that they could be incorporated into the baseline. Also, the Contractor discussed any requirements that were not achievable with current or near-term technologies in the PMRs and technical meetings.

Special Studies. Special studies, such as Science Advisory Boards (SABs), Mission Area Analysis and

Operational Cost and Effectiveness Analysis (MAA/COEA), AFSC, or User-directed studies, occurred in the ATF D/V phase (23). The above documentation reflected the results from these studies, if required. In addition, existing tools and the database were used to accomplish these studies.

Science Advisory Board. The SPO did not need to generate any additional data, or develop new analytical tools for this effort. The SPO integrated the User, AFOTEC, Foreign Technology Division (FTD), Air Force Chief of Staff/Studies and Analysis (AFCS/S&A), Defense Intelligence Agency (DIA), and AF/IN into this effort to, primarily, coordinate the information.

MAA/COEAs. The SPO did not need to generate any additional data, or develop new analytical tools for this effort. The SPO integrated the User, AFOTEC, FTD, AFCS/S&A DIA, and AF/IN, into this effort to, primarily, coordinate the information.

Inquiries from External Sources. The ATF SPO was able to address these inquiries very quickly with the matrix and the trade study database.

Simulation Data. Simulation is an analytical tool which can support a number of efforts that could arise during the D/V phase, such as MAA/COEAs, sensitivity analyses, SABs, and special studies, directed by outside agencies. More importantly, they were used by the ATF SPO

to validate the contractor effectiveness analysis results, and to measure the tactical utility of a given weapons system, or subsystem design (1). The simulation tools, such as TAC BRAWLER, incorporated the most current baseline threat, mission scenario, and Man-In-The-Loop (MITL) data. Successful baselining and integration of these activities added justification and traceability to the requirements generation process. This area was always a topic of the quarterly program reviews.

Threat. The program director ensured that the Government and the Contractor were using a baselined threat description. He also ensured that the User and the appropriate participating agencies were involved in baselining the threat description. In order to accomplish this, the SPO established a Threat Working Group (TWG) to control and coordinate this activity.

Mission Scenarios. The program director ensured that the Government and the Contractor were using approved mission scenarios in the D/V activities. He ensured that the User and the appropriate participating agencies were involved in definition and approval of the mission scenarios. In order to accomplish and control this process, the SPO established a Mission Scenario Group (MSG).

MAN-IN-THE-LOOP (MITL). The SPO established and coordinated a MITL program. The purpose of the MITL activity was to obtain expert feedback from pilots,

operational and test, on the scenarios, tactics, and the cockpit development effort (42).

TAC BRAWLER. The program director ensured that the Government and the Contractor were using the same version of TAC BRAWLER. He ensured that the user and the participating organizations were involved in the definition and the baselining of TAC BRAWLER model for the D/V effort. In order to accomplish this, the SPO established a TAC BRAWLER Group (TBG) to control this effort.

Other Simulations. The SPO also contracted for independent analyses of the prime contractor's effectiveness study results (Mission Effectiveness Analysis), and for separate in-house studies. The SPO and the User approved the analytical tools that were used by other contractors.

Investigative Question IV. How can these engineering and management techniques be generalized and applied to other major Air Force acquisition programs?

Handbook. The most appropriate method would be through a handbook. The objective of this study was to develop such a draft handbook. There was not enough time in this study to coordinate the handbook with the appropriate organizations, including the ATF SPO, and to get it into the proper format. In addition, additional study would be required to expand the handbook into a training tool.

Journal Article. Again, this is outside the scope of this study, but an article could be written with the assistance of the thesis advisor, and approval by the ATF SPO.

Briefing. The results of the study could be summarized into a briefing for the APEX committee and other ASD program directors but the idea would have to be coordinated with the ATF SPO.

Investigative Question V. Into which acquisition phase should the program director implement the ATF interface process with the User? (The production and deployment phases do not apply to this question.)

Concept Exploration and Definition Phase. Many of the concepts and techniques do not apply to the CE/D phase due the limiting assumptions. A SPO is not formed until D/V. Also, the functional participants that participated in the ATF ESC approach are not in place in the CE/D phase. Finally, the level system definition and design and threat information that would be needed to design or baseline the database and the analytical tools would not be available in this phase.

Demonstration and Validation Phase. The handbook was designed to assist a program director with a program in the D/V phase. Please refer to the research objective.

Full Scale Engineering and Development Phase. A separate study would be required to determine the applicability of the ATF ESC user-interface process concepts and techniques to FSED. The ATF SPO planned to use many of the same techniques in FSED.

Investigative Question VI. What approval cycle is required to implement the ATF ESC interface process with the User? The ATF ESC user-interface process concepts and techniques were developed, in part, from Senior Air Force leadership direction. The process has been in operation for four years, and it has been accepted by the implementing, supporting, participating, and supporting command representatives involved in the ATF program. It was also assumed, up front, that the ATF ESC interface process could be used by other major acquisition programs in the D/V phase. Therefore, a comprehensive review of Air Force policy and guidance was outside the scope of this study.

Recommendations

The study recommended that the ATF ESC user-interface process handbook be formalized and provided to other SPOs as a management tool for establishing an effective SPO-User relationship. At a minimum, this will require additional research, and a thorough review by the ATF SPO. Additional interviews will also be required to understand the proper format for the handbook, and the process of formalizing the handbook through Air Force channels. Meanwhile, a technical

paper could be published in Air Force journals. Or, briefings could be given to APEX committee participants, or SPO directors with new programs at ASD. Currently, however, it is assumed that the draft handbook applies to major programs in the D/V phase.

Recommendations for Further Research

The study also proposed some additional research that could be related to the APEX initiatives and this study. Each of these topics will be discussed, separately, next.

Training Handbook. The User expressed an interest in using the ATF ESC interface process with the User handbook as a training tool, much like the TAF Requirements Process Handbook (52). This would require additional information on the acquisition process to be incorporated into the draft ATF ESC user-interface process handbook.

AFSC/AFLC Merger. The ATF ESC user-interface process concepts would still apply. However, additional research would be required to address the applicability of some the organizational methods used by the ATF SPO.

General Applicability of Handbook. The study was based on some limiting assumptions that have already been discussed. Currently, it is applicable to the D/V phase of major acquisition programs. The acquisition process was also presented from an ATF SPO point-of-view. Therefore, a comprehensive review of Air Force acquisition policy and

documentation to determine the appropriateness of the user-interface concepts would need to be done. In addition, the handbook may already need to be updated due the changing nature of Air Force acquisition guidelines and terminology.

Applicability of Handbook to FSED. The ATF SPO planned to use the same approach in FSED. However, additional research would be required to determine if any changes would need to be made to the current draft handbook.

Effectiveness Of ATF ESC User-Interface Process. After the ATF program is two to three years into FSED, the effectiveness of the ATF ESC process could be measured against the F-15 and F-16 programs by comparing the type and number of changes to the technical/operational characteristics documented in the Selected Acquisition Reports (SARs).

Chapter Summary

The study recommended that the handbook be formalized and provided to other SPOs as a management tool for establishing an effective SPO-User relationship. The handbook could be modified and used as a SPO training tool with additional research and documentation. The handbook could also be modified to address the AFSC/AFLC merger as well as FSED, but additional research would need to be accomplished. Finally, after the ATF program is two to three years into FSED, the effectiveness of the ATF ESC process could be measured against the F-15 and F-16 programs

by comparing the number and type of changes to the technical/operational characteristics documented in the Selected Acquisition Report (SAR).

APPENDIX A

ADVANCED TACTICAL FIGHTER (ATF)
EARLY, STRUCTURED, AND CONTINUOUS (ESC)
SPO-USER TEAM-BUILDING PROCESS
DRAFT HANDBOOK

This handbook is divided into eleven sections. The introduction is in Section 1.0. A complete listing of the study assumptions is in Section 2.0. The study criteria, which were identified by the Acquisition Process Excellence (APEX) Team, are discussed in Section 3.0. A summary of the ATF program is in Section 4.0. The ATF ESC user-interface process is briefly discussed in Section 5.0. The reference documents are listed in Section 6.0. The ATF management and engineering concepts that respond to the first APEX committee finding, good cooperation and exchange of ideas, are identified and discussed in Section 7.0. The ATF management and engineering concepts that respond to the second APEX committee finding, disciplined requirements generation, are identified and discussed in Section 8.0. The ATF management and engineering concepts that respond to the third APEX committee finding, team approach, are identified and discussed in Section 9.0. The ATF management and engineering concepts that respond to the fourth APEX committee finding, exclusion from acquisition process, are identified and discussed in Section 10.0. Finally, the ATF management and engineering concepts that respond to the fifth APEX committee finding, synergism of documentation, are discussed in Section 11.0.

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LIST OF ACRONYMS/DEFINITIONS

In order to understand any aspect of the acquisition process, which includes the operational requirements process, it is necessary to familiarize the User with some related terminology. These are:

1. Acquisition process. A term used to cover the entire process of acquiring weapons from requirement generation, research, development, test and evaluation, production, operational support, product improvement, and final disposal.

2. Air Force Flight Test Center (AFFTC). Performs experimental flight testing of aircraft and aerospace vehicles entering the Air Force inventory or that of other services.

3. Air Force Logistics Command (AFLC). Major Air Force command responsible for logistically supporting all Air Force activities as well as other DoD and federal agencies. The supporting command (19:68). Also known as the supporting command.

4. Air Force Operational Test and Evaluation Command (AFOTEC). Responsible as the Air Force's independent manager for operational test and evaluation (OT&E) of weapon systems and other hardware (19:112)

5. Air Force Systems Command (AFSC). Major Air Force command responsible for total Air Force research, development, testing, evaluation, and contracting for production of aerospace systems. Also known as the implementing command (14:Vol VII,21).

6. Air Training Command (ATC). Major air command responsible for training aircrews and maintenance personnel. Also known as the participating command.

7. Aeronautical Systems Division (ASD). Division of Air Force Systems command responsible for directing the design, development, and acquisition of major aerospace systems.

8. Armament Working Group (ARWG). Consists of project managers, engineers, pilots, Operation and Support (O&S), Manpower Personnel and Training System (MPTS), and contractor personnel who are responsible for providing recommendations to the program director on armament integration issues (3; 4; 5; 11; 12).

9. Avionics Working Group (AWG). Consists of project managers, engineers, pilots, Operation and Support (O&S),

Manpower Personnel and Training System (MPTS), and contractor personnel who are responsible for providing recommendations to the program director on avionics issues (3; 4; 5; 11; 12).

10. ASD/YF. The Advanced Tactical Fighter System Program Office. Organization within ASD responsible for managing the design, development, and acquisition of the Advanced Tactical Fighter (ATF).

11. ATF Integrated Maintenance System (AIMS).

12. Air Logistics Center (ALC). Organization within AFLC assigned system and commodity responsibilities on a worldwide support basis for specified systems (19:80).

13. Associate Contractor Agreement (ACA). An agreement between two or more contractors (government not involved) to provide top-level cost, schedule, and performance data, answer phone calls, and attend meetings.

14. Computer-Aided Acquisition and Logistics (CALS).

15. Cockpit Working Group (CWG). Consists of project managers, engineers, pilots, Operation and Support (O&S), Manpower, Personnel, Training, and Safety (MPTS), and contractor personnel who are responsible for providing recommendations to the program director on cockpit issues (3; 4; 5; 11; 12).

16. Concept Exploration/Definition (CE/D) phase. Weapon system acquisition phase where a SPO explores generic design alternatives to satisfy a stated mission need.

17. Cockpit Automation Technology (CAT). Advanced development program responsible for development of a highly disciplined and structured crew system design process including the supporting design tools and technology (14:Vol VII,6).

18. Cost Model. Estimating tool consisting of one or more cost estimating relationships, estimating methodologies, or estimating techniques used to predict the cost of a weapon system and its components (14:Vol VII,14).

19. Defense Acquisition Board (DAB). Top level DoD corporate body for system acquisition responsible for providing advice and assistance to the Secretary of Defense. Reviews the weapon system acquisition at milestone decision points (14:Vol VII,22).

20. Demonstration/Validation (D/V) phase. Weapon system phase where program characteristics (performance, cost, and schedule) are validated and refined through extensive study and analysis, hardware development and prototype testing. (14:Vol VII,22).

21. Defense Management Review (DMR).

22. Developmental Test and Evaluation (DT&E). Verifies the technical performance specifications and objectives are met. Includes test and evaluation (T&E) of components, subsystems, hardware/software integration, related software, and models of the system. T&E of compatibility and interoperability with existing and planned equipment and systems is also included (14:Vol VII,26).

23. Design to Cost (DTC). A management concept wherein rigorous cost goals are established during development and the control of system costs (acquisition, operating, and support) to these goals is achieved by practical tradeoffs between operational capability, performance, cost, and schedule. Cost, as a key design parameter, is addressed on a continuing basis and as an inherent part of the development and production process (14:Vol VII,26).

24. Depot Training System (DTS).

25. Engineering Change Proposal (ECP). Formal proposal by contractor for modification to the weapon system.

26. Full Scale Engineering Development (FSED). The weapon system acquisition phase where the weapon system is designed, fabricated, and tested.

27. Foreign Technology Division (FTD). Responsible for acquiring, collecting, analyzing, producing, and disseminating foreign aerospace scientific and technical intelligence related to current capabilities and potential threats of major adversary powers in support of AFSC and other agency requirements (19:64).

28. Government Furnished Equipment (GFE). Items in possession of, or acquired by, the Government and deliverable to or made available to the contractor (14:Vol VII,39).

29. Implementing Command. See Air Force Systems Command.

30. Interface Control Document (ICD). Contractor-generated documents which describe the means (hardware, software, and data) by which the weapon system components are interfaced

with each other, with other subsystems, and with planned systems.

31. Initial Operational Test and Evaluation (IOT&E). Testing which provides estimate of weapon system's operational effectiveness and suitability.

32. Instructional System Development (ISD).

33. Integrated Logistics Support (ILS). The process that identifies the organic Air Force Functions required to support O&S in a timely, systematic, and orderly manner. The process requires continual analysis of design to determine logistics impacts and to select those that minimize logistics support burdens on the O&S commands, and to make certain that logistics support is available at the operating location upon delivery of the system or equipment for use (14:Vol VII,44).

34. Joint Integrated Avionics Working Group (JIAWG).

35. MAJCOM. Major Command.

36. Milestone. Major program decision points which require Secretary of Defense approval to proceed with the weapon system acquisition. Milestone 0 proceeds CE/D phase. Milestone I proceeds D/V phase. Milestone II precedes FSED (14:Vol VII,51).

37. Mission Area Analysis and Operational Cost Effectiveness Analysis (MAA/COEA).

38. Mission Need. Deficiencies (threat changes, decreased performance of older systems, or national security policy changes), technological opportunity or expanded mission which created the need for a new or modified weapon system (14:Vol VII,51).

39. Mission Element Need Statement (MENS). User-generated document which contains information on mission and threat, alternative concepts, technology, and funding implications of the weapon system development (14:Vol VII,51).

40. Memorandum of Agreement (MOA).

41. Manpower, Personnel, Training and Safety (MPTS).

42. Maintenance Training System (MTS).

43. Naval Air Systems Command (NAVAIRSYSCOM).

44. Organizational Intermediate (O&I).

45. Operations and Support (O&S).

46. Office of Management and Budget (OMB) Circular A-109. This document is the institutional basis for major systems acquisitions for all executive agencies. It contains management principles for research, development, and acquisition (14:Vol VII,37).

47. Operational Requirements. Requirements specified by the user and support command including the Statement of Need (SON), the System Operational Requirements Document (SORD), and Depot Support Requirements Document (DSRD), and scenarios (14:Vol VII,54).

48. Program Management Direction (PMD). Document issued by HQ USAF assigning program responsibility to Air Force field commands. AFSC Form 56 (issued by HQ AFSC) assigns specific program responsibility to AFSC organizations.

49. Pre-Production Verification (PPV).

50. Required Assets Available (RAA).

51. Research and Development (R&D).

52. Scenarios. Complete description of a mission including force compositions, targets, mission objectives, and timeliness (14:Vol VII,66).

53. Schedule. Description of sequence of events and their relationships for the development of a weapon system.

54. Statement of Need (SON). Document generated by the user which identifies the initial mission need in general operational terms. Includes a Parametric Spreadsheet which describes the essential characteristics and quantitative/qualitative performance and technical requirements the user deems relevant to the mission success. Also includes a rational and requirements change sheet which provides an audit trail for agreed-to program changes, cost and performance tradeoffs, growth plans, and supporting rational for decisions (14:Vol VII,69).

55. System Operational Requirements Document (SORD). Document generated by the User which amplifies and refines on the SON by describing pertinent variables associated with candidate system's operation, deployment, employment, support, training, manpower, etc..(14:Vol VII,69).

56. System Program Office (SPO). AFSC divisional organization that is responsible for a weapon system acquisition program.

57. Tactical Air Command (TAC). Major Air command responsible for tactical air operations including counterair, air interdiction, and close air support.

58. Tactical Air Command Liaison Officer (TACLO). TAC representative collocated in the SPO.

59. Tactical Air Force (TAF). Consists of USAFE, TAC, PACAF.

60. Test and Evaluation Master Plan (TEMP). An overall test and evaluation plan designed to identify and integrate the effort and schedules of all T&E to be accomplished within an acquisition program. Specifies test objectives, expected methods of test, data requirements, resource requirements, and data reduction/analysis techniques. Overall, the TEMP states how tests will be conducted and how these results will be used to verify the stated requirements (14:Vol VII,78).

61. Test Planning Working Group (TPWG). Consists of project managers, test managers, engineers, pilots, Operation and Support (O&S), Manpower, Personnel, Training, and Safety (MPTS), and contractor personnel who are responsible for providing recommendations to the program director on test issues (3; 4; 5; 11; 12).

62. Trained Personnel Required (TPR).

63. User. End-user of the system being acquired (14:Vol VII,81).

64. USAF laboratories. Organizations responsible for conducting Air Force R&D programs. Include Armstrong Aerospace Medical Research Laboratories (AAMRL), Wright Research and Development Center (WRDC Labs), Munitions System Division (MSD), and Rome Air Development Center (RADC) (14:Vol VII,81).

FOREWORD

This handbook, the product of a comprehensive study of the Advanced Tactical Fighter Early, Structured, and Continuous interface process with the user, was developed to support a continuing Command-wide effort to improve the process for acquiring weapon systems. Its goal was to document the ATF ESC user-interface process and provide a management tool to other Air Force acquisition programs. It was originally designed to assist other SPOs in developing and maintaining early, structured, and continuous interface with the user throughout the Demonstration and Validation phase of an acquisition program.

This is a preliminary, draft copy of the handbook. It is currently being coordinated with the ATF SPO. It will be properly reviewed and coordinated when a final copy is completed, and it is determined how the handbook will be used by the Air Force.

SECTION 1.0
INTRODUCTION

Historically, the user has inadvertently been excluded from the acquisition process after the approval of the Mission Element Need Statement (MENS), or became proactive after the weapon system design was baselined. Typically, therefore, the process of identifying and refining weapon system requirements through the trade study process is not responsive to program changes, and the results lack justification and traceability because SPOs have not developed an early, structured, and continuous interface with the user.

The ATF ESC SPO-User team-building handbook discusses specific management and engineering activities that were implemented by the ATF SPO in response to a need for a better relationship between the SPO and the user during the acquisition process. Currently, it is applicable to the Demonstration and Validation phase of major acquisition programs. The acquisition process is presented from an ATF SPO viewpoint including: roles and responsibilities of Government and contractors; documentation generated by a SPO; objectives of the Demonstration and Validation phase.

This version of the ATF ESC handbook is a preliminary, draft document. It has not been fully coordinated with the ATF SPO.

Any questions or comments concerning the ATF ESC handbook should be directed to Captain Robert K. Barry, AFIT/LSG, Wright-Patterson AFB OH, AUTOVON 785-8989; or, Major Janet Bloom, ASD/YFM, Wright-Patterson AFB OH, AUTOVON 785-1422.

SECTION 2.0
ASSUMPTIONS

The handbook was designed as a management tool for integrating the user into the acquisition process. Consideration should be given to the following assumptions when planning and implementing a user-interface process based on some of the ATF concepts.

1. Based on draft Defense Management Review (DMR) directions, a System Program Office will not be formed until after Milestone I (15).
2. User deficiencies/needs were validated by the Milestone 0 decision (15).
3. Concept Exploration and Definition funding pool was available to fund the concept direction studies and development of alternative technical solutions (15).
4. The primary participants in the ATF ESC process were the System Program Office, user, contractor, and AFSC.
5. The customers of process were the user, DAB II process, D/V program directors, Science Advisory Boards (SAB), System Design Reviews (SDRs), Mission Area Analysis/Cost and Operational Effectiveness Analysis (MAA/COEAS), program reviews, Technical Interchange Meetings (TIMs), and working groups.
6. The ATF ESC process was planned and implemented in the Demonstration and Validation phase.
7. Major programs were addressed, but the philosophy may be applicable to less-than major programs.
8. The System Program Office specified the requirements in the form of a threat description and preliminary weapon system specification.
9. The acquisition strategy involved contractor teaming arrangements, competition, and prototyping.

SECTION 3.0
APEX TEAM

General Randolph, former commander of Air Force Systems Command (AFSC), spearheaded an initiative in 1989 that sought out ways to improve the current acquisition process. Major changes were required because of today's environment of declining resources and clear emphasis on technological solutions to our nation's defense needs (15; 39). This initiative later became known as APEX. The mission of APEX was to create a revolutionary team acquisition process that destroyed barriers, inspired opportunity for improvement,

Hundreds of interviews were conducted by APEX team members to identify no-value-added tasks associated with the acquisition of weapon systems which could or should be deleted or improved (15). Program directors, project managers, industry, users, functional organization personnel, and acquisition executives from other services were interviewed by the team interviewees (15). In addition to the perceived problems and problem areas, more than 300 improvement ideas were identified.

The APEX team concluded, in part, that SPOs needed to develop a better interface process with their participants, including the user, particularly in the early phases of the acquisition process (15). Also, the study identified a number of concern areas associated with the requirements generation process which it felt every SPO-user team-building strategy should consider (16):

a. Good Cooperation and Exchange of Ideas. The program director and his user counterpart must create an environment of openness and trust. They must be committed to the establishment of an effective SPO-user team process. They must also ensure that the personnel responsible for implementing the user-based interface strategy have the necessary guidance. The user must be integrated into the acquisition strategy, and be involved in every aspect of the program.

b. Disciplined Requirements Generation. The user believes the requirements definition process should be separated from the Planning Programming and Budgeting System (PPBS) process. The requirements process is set up to make informed cost-schedule-performance-tradeoffs at critical points during the acquisition process. Whereas, the PPBS typically is not set up to make informed affordability assessments and resource allocation decisions on defense acquisition programs. Moreover, SPO analysis techniques do not adequately reflect cost and schedule constraints. Also, the user feels that AFSC needs to commit to Preplanned Product Improvement (P3I) programs earlier in the acquisition cycle.

c. Team Approach. The SPO user-interface strategy should consider a team acquisition strategy throughout the

life of the program. The user should be involved in the day-to-day decisions. The team should operate with complete candor. The user also needs to be better educated in the acquisition process.

d. Mission Area Analysis/Cost of Operational Effectiveness Analysis (MAA/COEA). Historically, AFSC has not committed the necessary resources to execute this analysis. Moreover, the user has been excluded from this analysis.

e. Concept DIR Studies. This concern is not applicable to this study.

f. Approach to Major and Non-Major Programs. This concern is not applicable to this study.

g. Exclusion from Acquisition Process. Typically, when the operational needs are identified, the user does not remain a responsible and useful partner in the development and acquisition process. Ideally, the user must be involved in every program action to ensure the TAF is provided with the best operational capabilities (39). Otherwise, the requirements process will not be as effective, and the contributions by the user will be less than optimal (39).

h. Improved Synergism of Documentation. A strategic plan needs to be developed up front to synergise all applicable program documentation. This includes clear system definition, a threat baseline, and standard simulations. It is critical that the system specification can be traced back to the system requirements and the Operational Requirements Document (ORD) through the trade study process. Also, the ORD should be updated after every major trade or program action rather than at every major milestone. All this is key to having accurate and timely information available when it is needed.

SECTION 4.0
PROGRAM SUMMARY

4.1 ATF PROGRAM OVERVIEW. The ATF is being developed as an Air Superiority fighter to dominate the threat in the year 2000 and beyond with a primary design mission of offensive counterair (13). Developing a system with improved performance characteristics, such as supersonic persistency, high maneuverability, and better combat radius, within congressionally mandated goals for a 50,000 pound aircraft at 35 million dollar average unit flyaway costs (base year 1985 dollars), was a challenging task requiring optimization of numerous variables which had to be treated in an integrated analysis (13).

The program just completed a competitive Demonstration and Validation (D/V) phase. During the D/V phase, the most promising technical alternatives from the Conceptual Exploration/Demonstration (CE/D) are refined by making performance tradeoffs whereby high-cost features providing only marginal performance gains are deleted from the system (37:301). It will enter Full Scale Development (FSD) in mid-1990. Production options are scheduled to be exercised beginning in 1996 with the Tactical Air Force receiving aircraft beginning in 1999.

4.2 SYSTEM DEFINITION AND DESIGN. The ATF was designed primarily for a single mission requirement-offensive counterair. The SPO director pushed the use of state-of-the-art technology and discriminate application and tailoring of military standards and specifications (30). He also desired 100 percent commonality and interoperability with existing O&S equipment. The trade study process which followed required extensive interaction between the technical people and the User in order to match requirements with achievable technologies (1).

4.3 TRADE STUDY APPROACH. The process will be described later on in the handbook. The process resulted in a match of requirements and available technologies to baseline an executable program in FSED (13). This led to an unprecedented level of technical understanding of the requirements and traceability to the original requirements. Cost was factored into requirements trades. This process identified the requirements that had to be flight tested in D/V. The program will enter FSD with low to moderate program risk in all areas. The TAC Commander reviewed the status of the contractor trade studies on an annual basis. This review required unparalleled teamwork between the SPO, user, contractor, and other government organizations. In short, the user had a willingness to adjust his requirements based on the contractor trade studies which demonstrated technical feasibility.

4.4 TAF REQUIREMENTS PROCESS. The ATF ESC process was implemented without changing the roles and responsibilities

of the Supporting, Operating, and Implementing commands. TAF management responsibility for acquisition programs also remained the same. This TAF management responsibility is summarized below.

4.4.1 REQUIREMENTS MANAGEMENT. TAC/DR maintains close contact throughout the entire acquisition process from program initiation to production and deployment and operational support (43). TAC/DR is subdivided into six directorates and three major Special Management Organizations (SMOs) to work and manage programs. Liaison offices were established to assist TAC/DR in its management function. DR has eight liaison offices located at selected Air Force activities, primarily AFSC divisions. They serve as the TAF representatives and play a major role in their management of TAF requirements during the acquisition process (43).

4.4.2 TAF/TAC RELATIONSHIP. TAC/DR is designated the requirements spokesman for the TAF (TAC, USAFE, PACAF) throughout the development and acquisition process (43). They perform the administrative functions of coordination, justification, and presentation of the TAF requirements (43).

4.4.3 POM/BES INVOLVEMENT. Another key aspect of TAC's involvement in the requirements process is their attempt to influence the formulation of the POM/BES to ensure that TAF's most urgent needs are funded (43). TAC POM working groups, with DR representatives and/or chairmen, are critical elements in the efficient and effective production of a prioritized listing of TAF RD&A programs for submission to Air Staff for their use during POM formulation (43).

4.4.4 TESTING RESPONSIBILITY. Testing is another vital ingredient in a successful acquisition program. There are two types of testing associated with acquisition: Development Test and Evaluation (DT&E) and Operational Test and Evaluation (OT&E). DT&E is normally performed by AFSC. TAC/DR is the responsible staff agency for all OT&E conducted within the command.

4.4.5 RELATIONSHIP WITH AFSC. TAC/DR is deeply involved with AFSC because they are responsible for the development and acquisition of weapon systems and support equipment that are responsive to the needs of the TAF (43:Chapter 5,17). It is important that TAC/DR and AFSC work closely throughout the acquisition process.

4.4.6 RELATIONSHIP WITH AFLC. TAC/DR is also involved with AFLC on programs which modify inventory systems and support equipment (43:Chapter 5,18).

4.4.7 RELATIONSHIP WITH THE CONTRACTOR. TAC/DR has frequent contacts with contractor representatives, and it is important that they understand what the Air Force expects that relationship to be (43:Chapter 5,19). The User was allowed to meet with the contractors without SPO

representatives present. However, they were required to send visit notifications for each visit.

4.5 THREAT. The program director ensured that the Government and the Contractor were using a baselined threat description. He ensured that the user was involved in baselining the threat description. He also ensured that the updates were properly identified, evaluated, coordinated, and incorporated into the threat description. In order to accomplish this, the SPO establish a Threat Working Group (TWG) to coordinate this process.

4.6 TEST PHILOSOPHY. The objective of the trade study process was to match requirements with achievable technologies (1). Analysis and test played a crucial role in defining and documenting these technologies as well as the potential Pre-planned Product Improvements (PPPI). Key concepts associated with the ATF test philosophy were as follows:

4.6.1 TEAM CONCEPT. The test manager ensured that the User, and the Contractor, O&S, MPTS, AFOTEC, flight test center, and ALD communities were involved in PMR, working group, test planning, and technical meetings.

4.6.2 TEMP. The test manager ensured that the User, and the Contractor, O&S, MPTS, AFOTEC, flight test center, and ALD communities were involved in the preparation and review of the TEMP.

4.6.3 CLASS III MOCKUPS. Since the prototypes were not available until late in the D/V program, the contractor built Class III mockups for supportability and maintainability demonstrations as well as the MPTS efforts (38).

4.6.4 "FLY-BEFORE-BUY". The SPO employed the "fly-before-buy" approach by testing with prototypes before committing funds to FSED.

4.6.5 AVIONICS FLYING LAB. The contractors used Avionics Flying Lab (AFL) to test avionics design concepts not planned to be tested on the prototypes. It also familiarized the pilots with the ATF avionics sweet.

4.6.6 GROUND TESTING. The contractor used ground testing to test systems, subsystems, and components that would not be tested on the prototype. Ground testing was also used to support flight testing, especially for the high-risk flight tests.

4.7 ORGANIZATION. The ATF was a very political program. It was also very important to the Air Force. It involved a large number of DoD and contractor organizations. The ATF SPO employed unique organizational techniques to maintain control of the program and the funding, and to remain a credible counterpart to the user. These techniques were discussed briefly below:

4.7.1 USER REPRESENTATIVES. User representatives from ATC, AFLC, and TAC were collocated in the ATF SPO.

4.7.2 O&S/MPTS EXPERTS. The DPML attempted to acquire maintainability experts for each opreational AFSC (30; 33; 38). The program director should also established a team of training experts within the SPO which was made up of ASD/RW and ATC representatives (41).

4.7.3 EXPERIENCED SPO PERSONNEL Personnel, pilots, trainers, and maintainers, with current and extensive backgrounds with the weapon system being procured, should occupy key engineering and management positions in the SPO.

4.7.4 ENGINE RESPONSIBILITY. The engine program is, typically, a separate program from the weapon system. However, the ATF SPO controlled the engine program which is normally managed by Deputy for Propulsion, Aeronautical Systems Division, ASD/YZ in other aircraft programs. These personnel were located in the ATF SPO and reported directly to the Program Director. This approach gave the Program Director complete control of the participating organizations during D/V.

4.7.5 AVIONICS SUPPORT. The ATF SPO controlled the technical support out of Deputy for Reconnaissance and Electronic Warfare, Aeronautical Systems Division, ASD/RW, which is normally collocated from ASD/RW. ASD/RW provides avionics technical support. These personnel were located in the ATF SPO and reported to the ATF program director.

4.7.6 LABORATORY TECHNOLOGY. The ATF SPO signed Memorandums of Agreement (MOA) with all the Air Force laboratories. They established and controlled technology panels which met on a periodic basis and involved AFSC, AFSC product divisions, Air Force laboratories, User, ALDs, and flight test communities. The purpose of these panels was to identify any technology that may be applicable to the ATF. The SPO also established a technology transition working group with the contractor which piggy-backed onto the trade study process.

4.7.7 ARMAMENT INTEGRATION. Munitions System Division (MSD) established an operating location within the ATF SPO to ensure a balanced weapon system design. A Memorandum of Agreement specified the required support. The MSD representative provided baseline weapons data to ensure total weapon system integration, and ensured armament program cost, schedule, technical, and program direction was consistent with the ATF program. The ATF SPO prepared a Weapons Integration Plan which was a major tool of the Armament Integration Working Group, and ensured the ATF design was a weaponized design.

4.7.8 TRAINING PLANNING TEAM. SPOs normally rely on MPTS support from the Training Advisory Office. On the other hand, the ATF SPO established a team of MPTS experts and collocated them in the their SPO (41). They established a Training Planning Team (TPT) to ensure that MPTS requirements were considered in the design process. The TPT will be discussed later on in the handbook (41).

4.7.9 MAINTENANCE TEAM. Refer to Section 8.0 for discussion on this concept.

4.8 INTEGRATED DESIGN APPROACH. Typically, O&S and MPTS requirements are considered only after the system design has been frozen. That is, the experts in this area have to use the results of the design process to find a supportability and MPTS answer to a fixed design (13). Another objective of ATF D/V approach was to force early integration of O&S and MPTS requirements into the weapon system design, and deliver a plan which ensured these requirements were met (13). The government process includes assembling a team with MPTS experts within the SPO to work MPTS requirements. This MPTS team can be extended to Training Planning Teams (TPT), expanding the scope of TPTs and providing a forum for MPTS discussions (13). The SPO had the same philosophy and approach in considering O&S requirements. This review did not address the corresponding contractor process and the relationship between the Government and Contractor process.

4.9 CONTRACTING APPROACH. The ATF program was a high-risk program. The system design approaches used state-of-the-art technology that required advanced manufacturing techniques. ATF SPO management directed its personnel to push Air Force policy and guidance to accommodate the ATF program. DoD also required each contractor to invest some of their own funds in the program due to the nature of the technologies. The contractors shared a greater percentage of the risk than on other D/V programs. Therefore, Firm Fixed Price contracts were let. The approach also involved an extended D/V phase, contractor teaming arrangements, competition, and prototyping.

SECTION 5.0
ATF ESC USER-INTERFACE PROCESS

The ATF SPO developed the ESC user-interface process in response to a need for a better relationship between the SPO and the user in their D/V phase. The relationship was critical during this phase because the SPO and the user had the greatest opportunity to change the weapon system design before it was baselined in Full Scale Engineering Development (FSED) (23). The primary objectives of the ATF ESC process were to add justification and accountability to the requirements process by involving and educating the user during the trade studies process, and to ensure their continued support in a very political program.

The user was involved in every aspect of the program to ensure the operational requirements became an integral part of the weapon system design process. The degree of interaction between the User and the engineering communities was unparalleled. Representatives from the TAF, Air Force Logistics Command (AFLC), and Air Training Command (ATC), for the ATF, were collocated in the program office and treated as members of the SPO. Formal agreements, such a Memorandum of Agreements (MOAs) were needed due to the program's support from senior Air Force management. The ATF SPO established a team of experts for the O&S and MPTS functions within the SPO to ensure that they were integrated into the system design. The user attended working groups, Technical Interchange Meetings (TIMs), program reviews, and briefings at all levels. The user participated in Mission Area Analysis/Cost and Operational Effectiveness Analysis (MAA/COEAs) and other ATF-related studies.

SECTION 6.0
REFERENCE DOCUMENTS

6.0 REFERENCE DOCUMENTS.

6.1 BACKGROUND DOCUMENTS.

a. ATF System Training Plan (STP), 14 Jan 1991.

b. Draft Concept Of Operations ATF Integrated Maintenance System (AIMS), 15 Aug 1990.

c. ATF Armament Integration Plan, 24 Feb 87.

d. Memorandum of Agreement (MOA) between ASD/YF AND MSD/CV, 26 April 88.

e. Sample Technology Fact Sheet, AFATL, Eglin AFB FL, 13 Sep 88

6.2 OTHER APPLICABLE DOCUMENTS.

a. ATF Armament Working Group Charter,

b. ATF Avionics Working Group Charter,

c. ATF Threat Working Group Charter,

d. ATF Cockpit Working Group Charter,

e. ATF Test Planning Working Group Charter,

SECTION 7.0
GOOD COOPERATION AND EXCHANGE OF IDEAS

7.0 The following concepts were used by the ATF SPO to ensure good cooperation and exchange of ideas with the user. The program director may want to consider these concepts when planning his/her D/V strategy.

7.1 MANAGEMENT COMMITMENT. The commitment by senior management to execute the ATF system definition and design concepts, and integrate the User, early, in the acquisition process was crucial to the success of the ATF ESC user-interface process (1). The Air Force Chief of Staff, TAC Commander, AFSC Commander, ALD Commander, and SPO director were all committed to creating an environment of openness and trust. The SPO director and his User counterparts also managed to create an environment of openness and trust because of their personalities and innovative management techniques. The SPO director may find some of the related concepts useful to his/her program.

7.2 EARLY USER INVOLVEMENT. Based on lessons learned from other programs, it is easier and less costly to integrate manufacturing, supportablility, maintainability, and cost into the initial design while it is evolving (1). This, can avoid costly weapon system modifications and upgrades at a later date. In order to accomplish this the SPO should recruit program managers, engineers, and maintainers with current backgrounds in the weapon system being acquired. They should be placed in key management and engineering positions. User representatives should also be brought into the SPO at the beginning of D/V. The maintenance personnel should be given the latitude (including TDY funding) by management to acquire and use any expert within DoD and the defense contractors in the required discipline areas, such as AIMs, IMIS, and MATE (30; 33; 38). Also, User and experts participation in PMRs, working groups, and technical meetings is part of education process, and is crucial to a program's success.

7.3 ORGANIZATION. The ATF SPO employed some unique organizational techniques to maintain control of the program and the funding, and to remain a credible counterpart to the user. These techniques were:

7.3.1 USER REPRESENTATIVES. User representatives from ATC, AFLC, and TAC should be collocated in the ATF SPO.

7.3.2 O&S/MPTS EXPERTS. The DPML should attempt to acquire maintainability experts for each operational AFSC (30; 33; 38). The SPO director should assemble a team of training experts within the SPO. The team should consist of ASD/RW, Training System Office (TSO), engineers, and ATC User-representatives.

7.3.3 EXPERIENCED SPO PERSONNEL Personnel, suac as pilots, trainers, and maintainers, with current and

extensive background in weapon system being procured, should occupy key engineering and management positions in the SPO.

7.3.4 ENGINE RESPONSIBILITY. The engine program is generally a separate program from the weapon system. However, the SPO should control the engine program which is normally managed by Deputy for Propulsion, Aeronautical Systems Division, ASD/YZ in other aircraft programs. The personnel should be located in the SPO and report directly to the Program Director.

7.3.5 AVIONICS SUPPORT. The SPO should also control the technical support out of Deputy for Reconnaissance and Electronic Warfare, Aeronautical Systems Division, ASD/RW, which is normally collocated from ASD/RW. ASD/RW provides avionics technical support. The personnel should be located in the SPO and report to the program director.

7.3.6 LABORATORY TECHNOLOGY. The SPO should sign Memorandums of Agreement (MOA) with all the Air Force laboratories. They should establish and control technology panels. These panels should meet on a periodic basis and involve AFSC, AFSC product divisions, Air Force laboratories, User, ALDs, and flight test communities. The purpose of these panels should be to identify any technology that may be applicable to the system. The SPO should also establish a technology transition working group with the contractor to ensure the contractor is not duplicating the efforts of the Air Force laboratories, and that he is informed about technologies that could be used on the weapon system. The contractor should not use the lab efforts to justify the incorporation of technologies into the baseline through the trade study process.

7.3.7 ARMAMENT INTEGRATION. Munitions System Division (MSD) should establish an operating location within the SPO to ensure a balanced weapon system design. A Memorandum of Agreement should be written to specify the required support. The MSD representative can be useful in providing baseline weapons data to ensure total weapon system integration, and ensured armament program cost, schedule, technical, and program direction was consistent with the program.

The SPO should also prepare a Weapons Integration Plan which should be a major tool of the Armament Integration Working Group. The objective of the ARWG should be to ensure the weapon system design is a weaponized design.

7.3.8 TRAINING PLANNING TEAM. SPOs normally rely on MPTS support from the Training Advisory Office. Based on the ATF program, however, the SPO should establish a team of MPTS experts and collocate them in the their SPO (41). The team should establish a Training Planning Team (TPT) to ensure that MPTS requirements are considered in the design process. The TPT will be discussed later on in the handbook (41).

7.3.9 MAINTENANCE TEAM. Refer to Section 8.0 for more information on the Maintenance Team.

7.4 USER PERSONNEL COLLOCATED IN SPO. Although the primary interface should be through TAC/DRB, collocating the User personnel in the SPO can be helpful to the SPO when TAC/DRB could not be reached. They can also provide continuity between the User and their SPO counterparts. They can open up the lines of communications, and ensure that the experts get involved. Specific roles and responsibilities of the User representatives that proved to be beneficial to the ATF SPO as well as the User are discussed, separately, below.

7.4.1 TACLO. The TACLO should be totally integrated into the SPO activities. He should attend staff meetings, PMRs, working groups, technical meetings, and briefings. He should be was allowed to participate in MAA/COEAs, SABs, and special studies as required. He should (20; 21; 23; 35; 42):

a. Talk to TAC/DRB daily.

b. Go TDY to TAC/DR once a month.

c. Write and coordinate trip reports as required with the SPO director, TAC/DRB, and other SPO personnel.

d. Be credible. Credibility with the fighter community was extremely important to generate an environment of openness and trust. Mutual trust results in open and honest exchange of even privileged information. Mutual trust also ensures that there are no surprises.

e. Have direct line to TAC/DR.

f. Be in place before the start of D/V.

g. Depending on areas of expertise, co-chair some of the working groups, such as the Scenario, Threat, and Cockpit Working Groups.

h. Be a member of Source Selection Evaluation Board (SSEB).

i. Be cleared to all programs at all levels.

j. Be allowed to attend SPO staff meetings.

k. Be required to attend all meetings, briefings, working groups, and Technical Interchange Meetings (TIMs).

l. Be allowed to participate in MAA/COEAs, Multiple Aircraft Reviews (MARs), Science Advisory Board (SAB) Reviews, and special studies, as required.

7.4.2 ATC User Representatives. The ATC User-representative should be totally integrated into the SPO activities. He should attend staff meetings, PMRs, working groups, technical meetings, and briefings. The roles and responsibilities of this ATC representative should be to (41):

a. Talk to ATC headquarters or ASD Training Advisory Office daily.

b. Write activity reports once a month. These reports should be reviewed by the SPO director, TPT team leader, and Training Advisory Office. Periodically, these reports may need to be sent to ATC headquarters.

c. Attend staff meetings, PMRs, working groups, technical meetings, and briefings. He should participate in MAA/COEAs, SABs, and special studies as required.

d. Be credible. Credibility with the training community was extremely important to generate an environment of openness and trust.

e. Assist the team in setting up a TPT, which will be discussed shortly.

f. Assist in the development of a training plan which should document how the team will ensure that the training concept developed and integrated into the design.

7.4.3 AFLC User Representatives. The DPML, with support from the SPO director, should attempt to assign a maintainability specialist for each operational AFSC. In addition, he/she should assign user representatives for each AFSC, or at least in the AFSCs that he is unable to fill with his/her own personnel. The O&S User-representatives should be totally integrated into the SPO activities. They should attend staff meetings, PMRs, working groups, technical meetings, and briefings. The roles and responsibilities of these User representatives should be (23; 30; 31; 33; 38; 41):

a. Talk to TAC/DRB, ALDs, and other supporting agencies daily.

b. Go TDY to TAC/DR once a month.

c. Write and coordinate trip reports as required with the SPO director, TAC/DRB, and other SPO personnel.

d. Be credible. Credibility with the fighter community was extremely important to generate an environment of openness and trust. Mutual trust results in open and honest exchange of even privileged information. Mutual trust also ensures that there are no surprises.

e. Be in place before the start of D/V.

f. Establish a Maintainability Team (MT). Engineering, TAC/DRBL, TAC/DRB, AFFTC, ATC, AFOTEC, maintainability specialists, ILS specialists, contractors, and other agency experts should be a part of the team. The MT should be the primary vehicle for getting O&S requirements integrated into the system design.

g. Be cleared to all programs at all levels.

h. Be allowed to attend SPO staff meetings.

i. Be required to attend all meetings, briefings, working groups, and Technical Interchange Meetings (TIMs).

j. Be allowed to participate in MAA/COEAs, Multiple Aircraft Reviews (MARs), Science Advisory Board (SAB) as required.

k. Be given the latitude (including TDY funding) by management to consult with experts within DoD and the defense contractors for lessons learned, or technical assistance.

l. Be allowed to use any team-building technique, such as the Integrated Process Development Team (IPDT) approach

to integrate themselves into the design process and to involve the engineers in the maintainability issues.

m. Participate in Joint Integrated Avionics Working Group (JIAWG) and other joint service activities. Use maintainability and ILS experts form other services to the maximum extent as possible.

n. Establish and coordinate Blue Two visits. Blue Two or TAC Reliability and Maintainability visits can be eye-opening experiences for the contractors. These visits can also be an important mechanism to get the engineering community educated on the maintainability issues.

o. Allow the User to deal directly with the contractor, but require that visit notifications be sent to the SPO. Freedom to interface with the contractor can afford them the opportunity to be educated on the design, understand what was actually achievable, and convey the user requirements to the contractor.

p. Be allowed to obtain the acquisition training upon before entering the SPO. This may require waivering grade on courses such as SYS 100, SYS 200, SYS 225, and SYS 228. SPO management, the DPML, and the supporting command should all be responsible for making this happen.

7.5 NAVY INVOLVEMENT.

7.5.1 THREAT AND EFFECTIVENESS EXPERTS. The following agencies and organizations can provide expertise in mission scenarios, threat, and effectiveness analysis:

7.5.2 O&S AND MPTS EXPERTS. The following agencies and organizations can provide expertise in RM&S and MPTS: NAVAIRSYSCOM/PMA 205-10/PMA XXX.

7.5.3 MANAGEMENT.

SECTION 8.0
DISCIPLINED REQUIREMENTS GENERATION

8.0 Disciplined requirements generation means integrating cost, MPTS, and O&S into the system design while it is still fluid. This requires early integration of the User into the acquisition process, and educating the User. It results in a match of requirements and achievable technologies to baseline an executable program at the start of FSED. It also identifies PPPI technologies, early, so that the weapon system is designed to defeat an evolving threat. It also allows the User to make informed decisions.

The ATF SPO used a common sense approach to system design and definition that required constant communication, openness and trust, and interaction between the engineers and the User that had never been achieved in the past. Some of the techniques used by the ATF SPO are as follows: understand the TAC requirements and use the best design philosophy to achieve them; educate and involve the User through the trade study process, Maintenance Team (MT) meetings, and Training Planning Team (TPT) meetings; direct the contractors to use the same analytical tools; ensure the Government is able to validate the contractors results; ensure the Government defines the mission scenarios and baselines the threat description; attempt to maintain commonality with existing O&S concepts; and, ensure the Government and Contractor to develop supporting documentation. The SPO, therefore, may want to employ some of these concepts which are discussed in more detail next (1; 20; 21; 23; 30; 31; 33; 38).

8.1 SYSTEM DEFINITION AND DESIGN. The SPO should attempt to focus the D/V efforts on a single mission requirement. The SPO director should push the use of state-of-the-art technology and discriminate application and tailoring of military standards and specifications, if applicable (30). He should also insist on 100 percent commonality and interoperability with existing O&S and MPTS equipment and concepts. The trade study process should require extensive interaction between the technical people and the User in order to match requirements with doable technologies.

8.2 TRADE STUDY PROCESS. The following process was employed very successfully by the ATF SPO, and resulted in a match of requirements and achievable technologies to baseline an executable program by FSED. It also identified PPPI concepts that were accounted for in the design. The process was as follows (1; 34; 40):

a. It started out with a number of generic concepts, based on the assumption that certain technologies would be available at the appropriate time, and broadly stated User requirements.

b. Then, the User choose a specific design concept.

c. And this is where the education process began:

(1) Through interaction between the engineers and the User, the User was educated on what was doable.

(2) Through analysis and testing the engineers came up with design concepts, based on the broadly stated User requirements, and the associated cost, technical, manufacturing, MPTS, and O&S characteristics. The cost and technical data was derived from a relative sensitivity cost model and the TAC BRAWLER effectiveness model.

(3) Based on this the User made performance tradeoffs.

(4) The above process was repeated with the SPO providing design alternatives with supporting data and the user making the performance tradeoffs.

d. The SPO also identified dates when the avionics, aircraft, and engine designs needed to be finalized.

e. The end result was a data base that matched requirements with doable technologies (with growth designed in for PPPI options) to baseline an executable program at FSED.

8.3 INTEGRATED DESIGN. By integrating the trade study activities, with the test, O&S, and MPTS activities the final design was not only doable, but it was an integrated design. Hence, the SPO should consider some of the following concepts when going through this process.

8.3.1 TEST PHILOSOPHY. Analysis and test play a crucial role in verifying and documenting the doable technologies as well as the potential PPPI technologies. The following test concepts should be considered in the D/V phase of the program:

8.3.1.1 TEAM CONCEPT. The test manager should ensure that the User, Contractor, O&S, MPTS, AFOTEC, flight test center, and ALD communities are involved in PMR, working group, test planning, and technical meetings.

8.3.1.2 TEMP. The test manager should ensure that the User, Contractor, O&S, MPTS, AFOTEC, flight test center, and ALD communities are involved in the preparation and review of the TEMP.

8.3.1.3 CLASS III MOCKUPS. Since the prototypes are, typically, not available until late in the D/V program, the contractor should be required to build Class III mockups for supportability and maintainability demonstrations as well as the MPTS efforts (38).

8.3.1.4 "FLY-BEFORE-BUY"/PROTOTYPES. The SPO should employ the "fly-before-buy" approach by testing with prototypes before committing funds to FSED.

8.3.1.5 AVIONICS FLYING LAB. The contractors should use an Avionics Flying Lab (AFL) to test avionics design concepts not planned to be tested on the prototypes, if applicable. Otherwise, the contractor should be required to assemble a full-scale ground test.

8.3.1.6 GROUND TESTING. The contractor should be required to use ground testing to test systems, subsystems, and components that will not be tested in the prototype. Ground testing should also be used to support flight testing, especially for the high-risk tests.
8.3.1.7 TEST INFORMATION SHEETS. The SPO should require draft Test Information Sheets (TISs) on all tests to be delivered at least 12 months in advance of flight testing.
8.3.1.8 ENGINEERING INSPECTION TEAMS (EITs). The SPO should encourage and support independent Engineering Inspection Teams (EITs) for all test activities. The primary concern of these teams should be to ensure that the testing support a higher-level requirement, and that it constitutes adequate risk reduction. SPO and User representatives should participate in these reviews as well.
8.3.1.9 GOVERNMENT FURNISHED EQUIPMENT (GFE). If the SPO acquires GFE from other organizations it should require a written letter from that SPO director, and at least a 90 day notice if a problem with the delivery should arise. The GFE list should be reviewed at least once a month by the SPO GFE manager.
8.3.2 Operations and Support (O&S). It is necessary for the SPO to develop techniques which will allow O&S requirements to be integrated into the design. The SPO may want to consider the following concepts which may prevent O&S personnel from using the results of the design process to find O&S answers to a fixed design (30; 33; 38; 41):
8.3.2.1 TEAM APPROACH. Assemble a team OF O&S experts within the SPO to work O&S requirements. This team should include the SPO, ATC, AFLC, and User representatives. Representatives from TAC should be collocated in the SPO too. The team should develop a plan which documents their approach to disciplined requirements generation, and they should establish a Maintenance Team (MT).
8.3.2.2 O&S PLAN. Should document their approach to disciplined requirements generation. Ensures that the O&S concerns and concepts are integrated into the design.
8.3.2.3 MAINTENANCE TEAM.
8.3.2.3.1 MT PARTICIPANTS. The MT membership should consist of designated representatives from each participating agency. The following organizations should be represented:

a. AFSC members:
   (1) SPO members:
   (2) Flight test Center members:
b. TAC members:
   HQ TAC/DRB
   /DRF
   /DOT
   /LGQ
   /DRI
   4444 OPS SQ

ASD/TACLO-A

c. ATC Members:
HQ ATC/TTO
3306 TDS
ASD/TTA
3752 FLDTS
3700 TCHTW

d. AFLC Members:
SM-ALC/LAT
OO-ALC/LIR
OC-ALC/LPA
SA-ALC/LPF
HQ AFLC/MMC

e. AFOTEC Members:
HQ/AFOTEC/TEF
/TEZ
/LGM
/OAH
DET 5, AFOTEC

f. Other participating organizations:
SAF/AQPF/AQPT
HQ USAF/XOOT/LEYM/DPPT/PRQE
AFMPC/DPMYF
NAVAIRSYSCOM/PMA 205-10/PMA XXX
AFSCS/SRPT

g. Weapon System Contractor(s)

h. Engine Contractor(s)

8.3.2.3.2 MT CHARTER. The MT will:

a. Assist and advise the program director in decisions made concerning the O&S.

b. Coordinate required Air Force inputs to the contractor O&S development effort.

c. Provide an open forum to exchange information on candidate O&S concepts and technologies for implementation in the weapon system, including transition of government Research & Development (R&D) efforts and providing inputs for the establishment of priorities for O&S R&D.

d. Identify MAJCOM activities required to ensure timely development of the O&S concept for weapon system deployment and coordinate accomplishment of those actions.

e. Convene MT meetings and update the plan, as required, but at least annually.

8.3.2.3.3 SPO RESPONSIBILITIES. The SPO, as the agent of the implementing command, should be responsible for the overall management of the program and ensuring that the O&S concept is integrated into the system acquisition program. The SPO will:

a. Chair the system MT.

b. Provide management for the definition, development, integration, test, and acquisition of the O&S concept and associated support.

c. Establish and maintain significant milestone schedules for the O&S concept based on the PMD.

d. Include the cost of O&S concept, associated support equipment, courseware, data, contractor-conducted ISD efforts, and interim contractor support into program cost estimates.

8.3.2.3.4 FLIGHT TEST CENTER (FTC) RESPONSIBILITIES. The FTC will:

a. Provide support to the SPO and participate in the acquisition effort for the O&S concept to include design reviews, course readiness reviews, and test and evaluation activities.

b. Identify FTC personnel O&S requirements to the SPO for interim contractor support to the CTF for DT&E and IOT&E.

c. Provide Subject Matter experts to support ongoing assessment/evaluation of the contractor development effort.

d. In conjunction with the SPO, TAC, ATC, and AFLC, develop plans for conducting DT&E of the O&S concept.

8.3.2.3.5 TAC RESPONSIBILITIES. TAC will:

a. Represent the TAF in the development of the O&S concept.

b. Provide O&S requirements updates to the SORD as required.

c. Provide facilities required at TAF bases to support and maintain the system.

d. Provide support to the SPO and participate in the acquisition effort for the O&S concept to include design reviews, course readiness reviews, and T&E activities.

e. Provide SMEs to support ongoing assessment/ evaluation of the contractor O&S development effort.

f. Solicit and consolidate inputs from TAF major commands.

g. In conjunction with the SPO, AFFTC, TAC, ATC, and AFLC, develop plans for conducting DT&E of the O&S concept.

8.3.2.3.6 ATC RESPONSIBILITIES. ATC will:

a. Provide facilities required at ATC bases to support O&S training.

b. Provide support to the SPO and participate in the acquisition effort for the training system to include design reviews, course readiness reviews, and T&E activities.

c. Provide instructional developers to support ongoing assessment/evaluation of the contractor O&S development effort.

d. Identify ATC personnel training requirements to the SPO for interim (Type 1) training.

e. In conjunction with TAC, determine responsibilities for delivery of maintenance training instruction (TAC, ATC, or contractor); budget and fund for MTS operations and support after RAA IAW these responsibilities.

f. In conjunction with AFLC and TAC, develop plans for management and operations and support contracts for the MTS after RAA.

g. In conjunction with the SPO, AFFTC, TAC, and AFLC, develop plans for conducting DT&E of the training system.

8.3.2.3.7 AFLC RESPONSIBILITIES. AFLC will:

a. Provide O&S requirements updates to the SORD as required.

b. Provide facilities required at AFLC bases to support and maintain the system.

c. Provide support to the SPO and participate in the acquisition effort for the O&S concept to include design reviews, course readiness reviews, and T&E activities.

d. Provide SMEs to support ongoing assessment/ evaluation of the contractor development effort.

e. In conjunction with the SPO, AFFTC, TAC, and ATC, develop plans for conducting DT&E of the O&S concept.

8.3.2.3.8 AFOTEC RESPONSIBILITIES. AFOTEC will:

a. Provide support to the SPO and participate in the acquisition effort for the O&S concepts to include design reviews, course readiness reviews, and T&E activities.

b. In conjunction with the SPO, AFFTC, TAC, ATC, and AFLC develop operational plans to conduct both an operational assessment and IOT&E of the O&S concepts.

8.3.2.3.9 WSC RESPONSIBILITIES. WSC will:

a. Design, develop, integrate, test, and deploy the O&S concept IAW the weapon system specification.

b. Provide interim contractor support.

c. Maintain an Associate Contractor Agreement (ACA) and Interface Control Document (ICD) with the engine contractor.

d. Ensure all ECPs on the weapon system or support system include a proposal for required changes to the O&S concept driven by the ECP.

8.3.2.3.10 ENGINE CONTRACTOR RESPONSIBILITIES. The Engine Contractor will:

a. Design, develop, integrate, test, and deploy the weapon system Engine O&S concept IAW the engine specification.

b. Provide interim contractor support.

c. Work with the WSC IAW Associate Contractor Agreement (ACA) and Interface Control Document (ICD).

d. Ensure all ECPs of the engine or engine support system include a proposal for required changes to the O&S concept driven by the ECP.

e. Provide facility requirements for O&S.

8.3.2.4 BLUE TWO VISITS. The SPO should coordinate Blue Two visits.

8.3.2.5 MOCKUPS. The SPO should coordinate maintainability demonstrations on the prototype or Class III mockups (38).

8.3.3. Manpower, Personnel & Training System (MPTS). It is necessary for the SPO to develop techniques which will allow MPTS requirements to be integrated into the design. The SPO may want to consider the following techniques which may prevent MPTS personnel from using the results of the design process to find MPTS answers to a fixed design (9; 41):

8.3.3.1 TEAM APPROACH. Assemble a team OF MPTS experts within the SPO to work MPTS requirements. This team should be made up of User as well as personnel from the Deputy for Training Systems (ASD/YW). The should be located in the SPO. They should establish a Training Planning Team (TPT) and A System Training Plan (STP).

8.3.3.2 SYSTEM TRAINING PLAN. Should document their approach to disciplined requirements generation. Ensures that the MPTS concerns and concepts are integrated into the design.

8.3.3.3 TRAINING PLANNING TEAM. The MPTS team should develop a Training Planning Teams (TPT).

8.3.3.3.1 TPT MEMBERSHIP. The TPT membership should consist of designated representatives from each participating agency. The following organizations shall be represented:

a. AFSC members:
   (1) SPO members:
   (2) AFFTC members:

b. TAC members:
   HQ TAC/DRB
   /DRF
   /DOT
   /LGQ
   /DRI
   4444 OPS SQ
   ASD/TACLO-A

c. ATC Members:
   HQ ATC/TTO
   3306 TDS
   ASD/TTA
   3752 FLDTS
   3700 TCHTW

d. AFLC Members:
   SM-ALC/LAT
   OO-ALC/LIR

OC-ALC/LPA
SA-ALC/LPF
HQ AFLC/MMC

e. AFOTEC Members:
HQ/AFOTEC/TEF
/TEZ
/LGM
/OAH
DET 5, AFOTEC

f. Other participating organizations:
SAF/AQPF/AQPT
HQ USAF/XOOT/LEYM/DPPT/PRQE
AFMPC/DPMYF
ASD/YWF/YWL/YWG/YWP/ALH/SDF
NAVAIRSYSCOM/PMA 205-10/PMA XXX
AFSCS/SRPT

g. Weapon System Contractor

h. Engine Contractor

8.3.3.3.2 TPT CHARTER. The TPT will:

a. Assist and advise the program director in decisions made concerning the training system.

b. Coordinate required Air Force inputs to the contractor training system development effort.

c. Provide an open forum to exchange information on candidate training concepts and technologies for implementation in the training system, including transition of government Research & Development (R&D) efforts and providing inputs for the establishment of priorities for training system R&D.

d. Identify MAJCOM activities required to ensure timely training system support for weapon system deployment and coordinate accomplishment of those actions.

e. Convene TPT meetings and update the plan, as required, but at least annually.

f. Work with AF manpower, personnel, and safety organizations to ensure implementation of the Integrated, Personnel, and Consolidated Training and Safety (IMPACTS) Program.

8.3.3.3.3 SPO RESPONSIBILITIES. The SPO, as the agent of the implementing command, should be responsible for the overall management of the system training program and ensuring that the training program is integrated into the system acquisition program. The SPO will:

a. Chair the system TPT.

b. Provide management for the definition, development, integration, test, and acquisition of the training system and associated support.

c. Establish and maintain significant milestone schedules for the training program based on the PMD.

d. Include the cost of training equipment, associated support equipment, courseware, data, contractor-conducted ISD efforts, and interim contractor training into program cost estimates.

8.3.3.3.4 FLIGHT TEST CENTER (FTC) RESPONSIBILITIES. The FTC will:

a. Provide support to the SPO and participate in the acquisition effort for the training system to include design reviews, course readiness reviews, and test and evaluation activities.

b. Identify FTC personnel tracing requirements to the SPO for interim (Type 1) training support to the CTF for DT&E and IOT&E.

c. Provide Subject Matter experts, including pilots and maintainers, to support ongoing assessment/evaluation of the contractor training development effort.

d. In conjunction with the SPO, TAC, ATC, and AFLC, develop plans for conducting DT&E of the training system.

8.3.3.3.5 TAC RESPONSIBILITIES. TAC will:

a. Represent the TAF in the development of the training system.

b. Provide training system requirements updates to the SORD as required.

c. Provide facilities required at TAF bases to support pilot and maintenance training.

d. Provide support to the SPO and participate in the acquisition effort for the training system to include design reviews, course readiness reviews, and T&E activities.

e. Provide SMEs, including pilots and maintainers, and instructional developers to support ongoing assessment/evaluation of the contractor training development effort.

f. Establish a system Simulator Certification (SIMCERT) program.

g. Identify TAF personnel training requirements to the SPO for interim (Type 1) training.

h. Develop and update estimates of TAF Trained Personnel Required (TPR) as required.

i. Budget and fund for operation and support of the pilot training system after RAA.

j. In conjunction with ATC, determine responsibilities for delivery of maintenance training instruction (TAC, ATC, or contractor); budget and fund for MTS operations and support after RAA IAW these responsibilities.

k. In conjunction with AFLC, develop plans for management and operations and support contracts for the PTS after RAA.

l. In conjunction with AFLC and ATC, develop plans for management and operations and support contracts for the MTS after RAA.

m. Solicit and consolidate inputs from TAF major commands.

n. In conjunction with the SPO, AFFTC, TAC, ATC, and AFLC, develop plans for conducting DT&E of the training system.

8.3.3.3.6 ATC RESPONSIBILITIES. ATC will:

a. Provide facilities required at ATC bases to support maintenance training.

b. Provide support to the SPO and participate in the acquisition effort for the training system to include design reviews, course readiness reviews, and T&E activities.

c. Provide instructional developers to support ongoing assessment/evaluation of the contractor training development effort.

d. Identify ATC personnel training requirements to the SPO for interim (Type 1) training.

e. In conjunction with TAC, determine responsibilities for delivery of maintenance training instruction (TAC, ATC, or contractor); budget and fund for MTS operations and support after RAA IAW these responsibilities.

f. In conjunction with AFLC and TAC, develop plans for management and operations and support contracts for the MTS after RAA.

g. In conjunction with the SPO, AFFTC, TAC, and AFLC, develop plans for conducting DT&E of the training system.

8.3.3.3.7 AFLC RESPONSIBILITIES. AFLC will:

a. Provide training system requirements updates to the SORD as required.

b. Provide facilities required at AFLC bases to support depot maintenance training.

c. Provide support to the SPO and participate in the acquisition effort for the training system to include design reviews, course readiness reviews, and T&E activities.

d. Provide SMEs, including depot maintenance and instructional personnel to support ongoing assessment/ evaluation of the contractor training development effort.

e. Identify AFLC personnel training requirements to the SPO for interim (Type 1) training.

f. Budget and fund for operation and support of the DTS after RAA.

g. In conjunction with ATC and TAC, develop plans for management and operations and support contracts for the MTS and PTS after RAA.

h. In conjunction with the SPO, AFFTC, TAC, and ATC, develop plans for conducting DT&E of the training system.

8.3.3.3.8 AFOTEC RESPONSIBILITIES. AFOTEC will:

a. Provide support to the SPO and participate in the acquisition effort for the training system to include design reviews, course readiness reviews, and T&E activities.

b. Identify AFLC personnel training requirements to the SPO for interim (Type 1) training.

c. In conjunction with the SPO, AFFTC, TAC, ATC, and AFLC develop operational plans to conduct both an operational assessment and IOT&E of the training system.

8.3.3.3.9 WSC RESPONSIBILITIES. WSC will:

a. Design, develop, integrate, test, and deploy the training system IAW the training system specification.

b. Operate and maintain the weapon system training system as required by the Air Force.

c. Provide interim (Type 1) training until training system RAA.

d. Maintain an Associate Contractor Agreement (ACA) and Interface Control Document (ICD) with the engine contractor to ensure integration of the engine contractor developed Organizational and Intermediate (O&I) level training components into the weapon system training system.

e. Ensure all ECPs on the weapon system or support system include a proposal for required changes to the training system driven by the ECP.

f. Provide facility requirements for the PTS, MTS, DTS, and TSSC.

8.3.3.3.10 THE ENGINE CONTRACTOR RESPONSIBILITIES. The Engine Contractor will:

a. Design, develop, integrate, test, and deploy the weapon system Engine Maintenance Training System (EMTS) IAW the engine specification.

b. Operate and maintain the weapon system EMTS as required by the Air Force.

c. Provide interim (Type 1) training until EMTS RAA.

d. Work with the WSC IAW Associate Contractor Agreement (ACA) and Interface Control Document (ICD) to ensure integration of the EMTS into the weapon system training system.

e. Ensure all ECPs of the engine or engine support system include a proposal for required changes to the EMTS driven by the ECP.

f. Provide facility requirements for DTS.

8.4 SIMULATION. Simulation is an analytical tool which can support a number of efforts that could arise during the D/V

phase, such as MAA/COEAs, sensitivity analyses, SABs, CAIGs, and special studies directed by outside agencies. More importantly, they can be used in D/V for validating the contractor effectiveness analysis results, the measuring tactical utility of a given weapons system, or subsystem design. The simulation tools, such as TAC BRAWLER, should incorporate the most current baseline threat, mission scenario, and Man-In-The-Loop (MITL) data. Successful baselining and integration of these activities will, therefore, add justification and traceability to the requirements generation process. This area should be a topic of the quarterly program reviews. SPOs may want to consider some of the following concepts in these areas.

8.4.1 THREAT. The program director must ensure that the Government and the Contractor are using a baselined threat discription. He must also ensure that the User and the appropriate participating agencies are involved in baselining the threat description. In order to accomplish this, the SPO should establish a Threat Working Group (TWG) to oversee this process.

8.4.1.1 TWG MEMBERSHIP. In addition to the agencies that have already been mentioned, the following agencies should participate in the TWG: AF/IN, AFCS/S&A, Foreign Technology Division (FTD), ASD/IN, ASD/ENSSS, and DIA.

8.4.1.2 TWG CHARTER. The TWG will (34):

a. Ensure the threat baseline is established.

b. Ensure the contractor is conforming to the threat description.

c. Periodically update the threat baseline.

d. Evaluate the most current data for inclusion into the threat baseline. The sources of data are:

8.4.1.3 SPO RESPONSIBILITIES.

8.4.1.4 FTC RESPONSIBILITIES.

8.4.1.5 TAC RESPONSIBILITIES.

8.4.1.6 FTD RESPONSIBILITIES.

8.4.1.7 DIA RESPONSIBILITIES.

8.4.1.8 INTELLIGENCE COMMUNITY RESPONSIBILITIES.

8.4.1.9 AFOTEC RESPONSIBILITIES.

8.4.1.10 WSC RESPONSIBILITIES.

8.4.1.11 THE ENGINE CONTRACTOR RESPONSIBILITIES.

8.4.2 MISSION SCENARIOS. The program director must ensure that the Government and the Contractor are using approved mission scenarios in the D/V activities. He/she must ensure that the User and the appropriate participating agencies are involved in the definition and approval of the mission scenarios. In order to accomplish this, the SPO should establish a Mission Scenario Group (MSG) to oversee this process (42).

8.4.2.1 MSG CHARTER. The MSG will:

a. Support the TWG, Cockpit Working Group, TAC BRAWLER, and MITL as required.

b. Ensure the contractor is conforming to the approved mission scenarios in his effectiveness analysis and MITL activities.

c. Periodically review and update as required.

8.4.2.2 MSG PARTICIPATION. The TWG membership should consist of designated representatives from each participating agency. The following organizations shall be represented:

a. AFSC members:
   (1) SPO members:
   (2) FTC members:

b. TAC members:
   HQ TAC/DRB
   /DRF
   /DOT
   /LGQ
   /DRI
   4444 OPS SQ
   ASD/TACLO-A

c. Other participating organizations:
   SAF/AQPF/AQPT
   HQ USAF/XOOT/LEYM/DPPT/PRQE
   AFMPC/DPMYF
   ASD/IN/ENSSS
   NAVAIRSYSCOM/PMA 205-10/PMA XXX
   AFCS/S&A
   Defense Intelligence Agency
   FTD

d. Weapon System Contractor

e. Engine Contractor

8.4.2.3 SPO RESPONSIBILITIES.
8.4.2.4 FTC RESPONSIBILITIES.
8.4.2.5 TAC RESPONSIBILITIES.
8.4.2.6 FTD RESPONSIBILITIES.
8.4.2.7 DIA RESPONSIBILITIES.
8.4.2.8 INTELLIGENCE COMMUNITY RESPONSIBILITIES.
8.4.2.9 AFSC/S&A RESPONSIBILITIES.
8.4.2.10 AFOTEC RESPONSIBILITIES.
8.4.2.11 WSC RESPONSIBILITIES.
8.4.2.12 THE ENGINE CONTRACTOR RESPONSIBILITIES.

8.4.3 MAN-IN-THE-LOOP (MITL). The SPO should establish an MILT program, if applicable.

8.4.3.1 MITL CHARTER. The MILT should be a subgroup of the CPWG (42). The group should consist of at least 12 test pilots and 12 operational pilots who periodically fly the simulator (42). The objective of the MITL activities should be to provide expert opinions and comments to the Government and the Contractor on the cockpit development, the mission scenario definition, and the tactics (42).

8.4.3.2 MITL PARTICIPATION. TAF, TAC, AFOTEC, AFSC FTCs, FTD, and the WSC.

8.4.3.3 SPO RESPONSIBILITIES. The SPO will:

a. Develop and approve the list of AFSC and TAC pilots participating in the MITL program.

b. Develop and maintain the MITL schedule.

c. Maintain a file of the pilot inputs associated with the MITL program.

d. Incorporate the inputs into the CPWG and MSDG, or the associated documentation, as required.

8.4.3.4 FTC RESPONSIBILITIES. The FTCs will:

8.4.3.5 TAC RESPONSIBILITIES. TAC will:

a. Identify a list of 12 operational pilots that will participate in the MITL program.

b. Ensure the pilots are available to support the program.

8.4.3.6 FTD RESPONSIBILITIES.

8.4.3.7 AFCS/S&A RESPONSIBILITIES.

8.4.3.8 AFOTEC RESPONSIBILITIES.

8.4.3.9 WSC RESPONSIBILITIES. WSC will:

a. Incorporate the inputs into the CPWG and MSDG, or the associated documentation, as required.

8.4.3.10 ENGINE CONTRACTOR RESPONSIBILITIES.

8.4.4 TAC BRAWLER. The program director must ensure that the Government and the Contractor are using the same version of TAC BRAWLER. He/she must ensure that the user and the participating organizations are involved in the definition and the baselining of TAC BRAWLER model for the D/V effort. In order to accomplish this, the SPO should establish a TAC BRAWLER Group (TBG) to oversee this process.

8.4.4.1 TBG CHARTER. The TBG will:

a. Support the TWG, Cockpit Working Group, special studies, and MITL as required.

b. Ensure the contractor is conforming to the approved version in his effectiveness analysis and MITL activities.

c. Periodically review and update TAC BRAWLER as required.

8.4.4.2 TBG PARTICIPATION. The TBDG membership should consist of designated representatives from: SPO, TAC, AFCS/S&A, FTD, AF/IN, ASD/ENSSS, FTCS, AND WSCS.

8.4.4.3 SPO RESPONSIBILITIES.

8.4.4.4 FTC RESPONSIBILITIES.

8.4.4.5 TAC RESPONSIBILITIES.

8.4.4.6 FTD RESPONSIBILITIES.

8.4.4.7 IN COMMUNITY RESPONSIBILITIES.

8.4.4.9 AFSC/S&A RESPONSIBILITIES.

8.4.4.10 AFOTEC RESPONSIBILITIES.

8.4.4.11 WSC RESPONSIBILITIES.

8.4.4.12 ASD/ENSSS RESPONSIBILITIES.

8.4.5 OTHER SIMULATIONS. The SPO may want to do an independent check of the prime contractor's effectiveness study results (Mission Effectiveness Analysis), or do a separate in-house study. Therefore, it may be necessary for the SPO to approve the analytical tools that will be used by

other contractors. This, too, should be discussed in the TBG. The same procedures for defining and approving the model(s) should apply.

8.5 DOCUMENTATION. Refer to Section 11.0, titled, Synergism of Documentation.

8.6 BUDGET MODEL. A relational, detailed budget model should be developed to validate the contractor data in relative terms, and cost proposed configurations as they were developed to match the latest set of requirements (23; 35). The model should not be limited to just Air Force data. Contractor data should be used as well.

8.7 MOAs and Working Group Charters. There will be a large number of organizations supporting the program office. The program director should ensure that these documents do not restrict or limit the technical support from these participating agencies. If a MOAs are used, it should address, but is certainly not limited to the number of people, their type of expertise.... The program director's objective should be to maximize the support from these organizations.

8.8 TECHNOLOGY TRANSITION. In order to minimize cost and properly integrate O&S and MPTS requirements into the design the SPO has to identify potential PPPI improvements as early as possible. These potential improvements have to be properly documented and tracked. The SPO should do this on fact sheets (refer to Appendix F). The SPO should establish a Technology Panel and a Technology Transition Working Group. Also, the participating members and their roles and responsibilities should be established as early as possible.

8.8.1 TECHNOLOGY PANELS. The TP will:

a. Review all Air Force technology programs and determine their applicability to the program.

b. Document, track, and periodically review the status of the programs.

8.8.2 TP PARTICIPATION AND RESPONSIBILITIES.

8.8.2.1 SPO RESPONSIBILITIES. The SPO will:

a. Chair the TP.

b. Coordinate and host the meetings, semiannually.

c. Document and track the action items through fact sheets (Refer to Appendix F).

d. Establish MOAs as required.

8.8.2.2 AFSC RESPONSIBILITIES. AFSC will

a. Participate in the TPs.

b. Coordinate Form 56/PMD documentation, as required.

8.8.2.3 SAF/AQL/AQP RESPONSIBILITIES. SAF/AQR/AQL will:

a. Participate in TPs.

b. Execute proper PMD direction, as required.

8.8.2.4 TAC RESPONSIBILITIES. TAC will:

a. Participate in TPs.

b. Present technology roadmap briefings, as required.

c. Represent the TAF.

d. Provide updates to the SORD as required.

e. Solicit and consolidate inputs from TAF major commands.

f. In conjunction with the SPO, AFFTC, TAC, ATC, and AFLC, develop plans for conducting DT&E of the O&S concept.

8.8.2.5 OTHER AGENCY PARTICIPATION. Other participating organizations will:

a. Participate in TPs as required.

b. Present status of applicable programs as directed by the SPO.

c. Acquire necessary program administrative changes as required to support the SPO.

8.9 CONTRACTOR INTERFACE The contractor is responsible for performing the trade studies. This process includes acquiring sufficient data to make requirements decisions and maturing technologies with which to enter FSD, both risk reduction activities. This is an iterative process in which the SPO provides the contractors a system requirement against which the contractors are applying trade studies and demonstration tools, and returning recommendations for changes to the requirement for better system optimization. These requirements recommendations were analyzed by the Air Force. Accepted recommendations are documented in the system specification and returned to the contractor as new requirements. This cycle was repeated annually during the D/V phase. The contractor will:

a. Establish and maintain ACAs and/or ICDs with the appropriate contractors. These will be updated in FSED.

b. Participate in PMRs, Working groups, technical meetings...

SECTION 9.0
TEAM APPROACH

9.0 In the case of the ATF program, a successful team-acquisition strategy appeared do be a byproduct of good communication and exchange of information and a disciplined requirements generation approach. The ATF SPO used innovative management and organizational concepts in these areas as well as an effective team-acquisition strategy through working groups, definition groups, technical meetings, PMRs, maintenance teams, and training team. They accomplished this without a need for MOAs or MOUs.

9.1 WORKING GROUPS. Working Groups should be established for armament, avionics, cockpit, test planning, and threat. These groups should consist of representatives from the applicable government and contractor organizations, they should be chaired by SPO management, and meet as required. Their mission should be to assist in the development of an integrated weapon system design.

9.1.1 ARMAMENT WORKING GROUP. See Attachment A. At a minimum, the purpose(s) of the ARWG should be (3):

a. Assist and advise the program director in decisions concerning the armament system.

b. Aid the WSC in executing a successful armament system development program.

c. Provide an open forum to exchange information on candidate technologies for the armament system development.

d. Allow the User and experts from participating agencies to participate in the armament system development effort.

e. Inform peripheral government organizations of progress by the WSCs in the armament system integration effort.

9.1.2 AVIONICS WORKING GROUP. See Attachment B. At a minimum, the purpose(s) of the AWG should be (4):

a. Assist and advise the program director in decisions concerning the avionics system.

b. Aid the WSC in executing a successful avionics development program.

c. Provide an open forum to exchange information on candidate technologies for the avionics system development.

d. Allow the User and experts from participating agencies to participate in the avionics system development effort.

e. Inform peripheral government organizations of progress by the WSCs in the avionics system integration effort.

9.1.3 COCKPIT WORKING GROUP. If applicable. See Attachment C. At a minimum, the purpose(s) of the CWG should be (5):

a. Assist and advise the program director in decisions concerning the cockpit.

b. Aid the WSC in executing a successful cockpit development program.

c. Provide an open forum to exchange information on candidate technologies for the cockpit development.

d. Allow the User and experts from participating agencies to participate in the cockpit development effort.

e. Inform peripheral government organizations of progress by the WSCs in the cockpit development effort.

9.1.4 THREAT WORKING GROUP. See Atachment D. At a minimum, the purpose(s) of the TWG should be (12):

a. Assist and advise the program director in decisions concerning the threat.

b. Provide an open forum to exchange information on current threat as well as new threat information.

c. Allow the User and experts from participating agencies to participate in baselining the threat.

d. Inform peripheral government organizations of the status of the threat baselining effort.

9.1.5 TEST PLANNING WORKING GROUP. See Attachment E. At a minimum, the purpose(s) of the TPWG should be (11):

a. Assist and advise the program director in decisions concerning T&E.

b. Aid the WSC in executing a successful T&E program.

c. Provide an open forum to exchange information on test planning and execution.

d. Allow the User and experts from participating agencies to participate in test planning.

e. Inform peripheral government organizations of progress by the WSCs in test planning and execution.

9.2 TECHNICAL MEETINGS.

9.2.1 MAINTAINABILITY. Refer to discussion on Maintenance Team in Section 8.0.

9.2.2 TRAINING. Refer to discussion on Training Planning Team in Section 8.0.

9.2.3 MAN-IN-THE-LOOP. Refer to discussion on MITL in Section 8.0

9.2.4 TECHNOLOGY TRANSITION. Refer to discussion of technology transition in Section 8.0.

9.3 PROGRAM REVIEWS. The User, User representatives, ALC representatives, HQ AFSC, SAF/AQR/AQL, AFOTEC, ATC, and AFLC should attend the reviews.

9.4 BRIEFINGS.

9.4.1 ALTERNATIVES.

9.4.2 Air Force Chief of Staff.

9.4.3 TAC/CC.

9.4.4 AFSC/CC.

9.4.5 SCIENCE ADVISORY BOARD.

9.4.6 DAB.

SECTION 10.0
EXCLUSION FROM ACQUISITION PROCESS

10.0 The following areas have been discussed, extensively, in this handbook. They represent "common sense" techniques that were developed from lessons learned, and supported by senior management. These areas, represent the starting point for a successful User-interface approach as well as techniques for attempting to include the User in the acquisition process.

10.1 MANAGEMENT COMMITMENT.

10.2 TRADE STUDY PROCESS. The key is to view this as an education process, and to get the engineers and the User to communicate.

10.3 TRAINING. This is, typically, a major problem for the User. This can be overcome through constant communication, SPO libraries, and assigning User personnel with SPO experience to the SPO. However, grade restrictions still prevent enlisted personnel from acquiring the necessary training.

10.4 EARLY USER INVOLVEMENT. The representatives needs to be in place by the start of D/V. Also, Maintenance and Training Team concepts have proven to be very successful in educating the User, involving him/her in the acquisition process, and integrating O&S and MPTS requirements into the system design.

10.5 EXPERIENCED SPO PERSONNEL.

10.5.1 O&S TEAM OF EXPERTS.

10.5.2 MPTS TEAM OF EXPERTS.

10.5.3 PILOT EXPERTS. Can be useful in education the User, and in supporting the CWG, MITL, and Effectiveness activities.

10.5.4 ANALYSIS. Bring in people from AFCS/S&A and engineering division to run the TAC BRAWLER and analysis activities. They interface well with ASD/ENSSS.

10.5.5 THREAT.

10.6 TEAM APPROACH. Refer to discussion in previous section, Section 9.0.

SECTION 11.0
SYNERGISM OF DOCUMENTATION

11.0 DOCUMENTATION. The following documents and analytical tools should form the database that will be used by the SPO to answer inquiries, justify the requirements, the trade study results, and the PPPI technologies (1). They should ensure that there is traceability throughout the program documentation as the requirements are being refined. These documents also form the data base which will be used to prove that there is a match between the requirements and the associated technology (1). Therefore, in order to accomplish these things, the SPO should develop a matrix which cross references each requirement through all these documents (38). In addition, the SPO should establish a team to periodically update the matrix, and ensure that the PSS and the SORD match one-for-one (38). The team should include SPO, User representative, engineering, TAC/DRB, AFOTEC, HQ AFSC, SAF/AQL/AQR, ATC, and AFLC personnel at a minimum (38).

11.1 SPO LIBRARY. This can be a useful training tool for SPO personnel as well as the User representatives. A SPO library will also maintain some continuity in the program.

11.2 PROGRAM MANAGEMENT DIRECTION (PMD). The User, HQ AFSC, and SAF/AQ representatives need attend working groups, PMRs, and technical meetings. This will enable the SPO to get the proper direction, quickly, if required. The headquarters personnel need to communicate with the SPO on a daily basis, and come TDY to the SPO at least once a month.

11.3 PRELIMINARY SYSTEM SPECIFICATION. The SPO and the User should ensure that the Draft PSS and the SORD match one-for-one before it is sent to the contractors. The SPO and the User should periodically review the PSS and SORD to see that they still match. The PSS should be updated when the User makes major tradeoffs in the requirements as described in the trade study process. In addition, the MSG, TBG, working groups, technical meetings, TPT, and MT should document proposed changes, and incorporate them into thee PSS and SORD when they are updated.

11.4 SYSTEM OPERATIONAL REQUIREMENTS DOCUMENT. The SORD should be updated after each tradeoff decision point rather than at the end of D/V, or a milestone decision point (23).

11.5 TRADE STUDY RESULTS. The contractor should reference the PSS and SORD paragraphs for each requirement, or trade study initiative. The contractor should develop a control chart for each SORD and PSS requirement. These charts should also delineate the associated risk reduction activities (analysis, test,..) required to reduce the level of risk so that they can be incorporated into the weapon system baseline. The contractor should also discuss any requirements that are not achievable with current or near-

term technologies in the PMRs. The contractor should also identify potential PPPI technologies.

11.6 SPECIAL STUDIES. Special studies, such as SABs, MAA/COEA, AFSC, or User-directed studies, are likely to occur through the course of the D/V phase. The above documentation should reflect the results from these studies, if required. Also, most of the data should be available to support these studies.

11.6.1 SCIENCE ADVISORY BOARD. The SPO should not need to generate any additional data, or develop analytical tools for this effort. The SPO should integrate the User, AFOTEC, FTD, AFCS/S&A, DIA, and AF/IN into this effort to coordinate the information.

11.6.2 MAA/COEA. The SPO should not need to generate any additional data for this effort. The SPO should integrate the User, AFOTEC, FTD, AFCS/S&A, DIA, and AF/IN into this effort to coordinate the information. In fact, the WSC may need to be involved.

11.6.3 INQUIRIES FROM EXTERNAL SOURCES. The SPO should be able to answer these inquiries very quickly with the matrix and the database

11.7 SPECIAL BRIEFINGS.

11.7.1 AIR FORCE CHIEF OF STAFF.

11.7.2 TAC/CC.

11.7.3 TAF.

11.7.4 AFSC/CC.

11.7.5 SABs.

Attachment A
ATF Armament Working Group Charter

The charter was not included in the draft handbook.

Attachment B
ATF Avionics Working Group Charter

The charter was not included in the draft handbook.

Attachment C
ATF Cockpit Working Group Charter

The charter was not included in the draft handbook.

Attachment D
ATF Threat Working Group Charter

The charter was not included in the draft handbook.

Attachment E
ATF Test Planning Working Group Charter

The charter was not included in the draft handbook.

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Vita

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13. ABSTRACT *(Maximum 200 words)*

The objective of this study was to develop a management tool that would improve the working relationship between the SPO and the User. It documented the Advanced Tactical Fighter Early, Structured, and Continuous User-Interface process in a draft handbook. The study found that the process was developed in response to senior Air Force leadership guidance, lessons learned, and ATF SPO management direction. The ATF SPO user-interface process was easily incorporated into their acquisition strategy, and it did not affect the requirements process or the associated players' roles and responsibilities. It has been in operation for over four years. The study recommended that the handbook be formalized. Additionally, it could be modified and used as a training tool. The handbook could also be updated to address the AFSC/AFLC merger as well as FSED, but more research would need to be accomplished. Finally, after the ATF program is two to three years into FSED, the effectiveness of the ATF SPO user-interface process could be measured against other Air Force fighter programs by comparing the number and type of changes to the technical/operational characteristics documented in the Selected Acquisition Report (SAR).

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